Final Report
Rural Telemedicine Evaluation Project
January, 2000
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A Distributed Telemedicine Application Based on Directory Services  David M. Witten II, Mihail Popescu, Robert Hodge, M.D.

Telemedicine As A Substitute For A Cardiology Outreach Clinic: Financial Implications  Keith E. Boles, Ph.D., Lanis L. Hicks, Ph.D., et al.


Do Patient Characteristics Count? A Dermatology Case Study  – Keith E. Boles, Ph.D., Lanis L. Hicks, Ph.D., et al.

Using Telemedicine to Avoid Transfer of Rural Emergency Department Patients  – Lanis L. Hicks, Ph.D., Keith E. Boles, Ph.D., et al.

Appropriate Pricing For Telemedicine Services  – Keith E. Boles, Ph.D., Lanis L. Hicks, Ph.D., et al.

An Analytic Bibliography for Telemedicine  Lanis L. Hicks, Ph.D., Keith E. Boles, Ph.D., et al.

A Method for Identifying Comparison Counties: Application to a Rural Telemedicine Evaluation Project  Lanis L. Hicks, Ph.D., S.E. Koenig, K.E. Boles et al.

Barriers To Acceptance Of Telemedicine Technologies In A Rural Setting  James D. Campbell, Ph.D., Kimberly D. Harris, Ph.D.

The Introduction Of Telemedicine Technologies In A Rural Setting: The Climate Of Change  James D. Campbell, Ph.D., Kimberly D. Harris, Ph.D., Robert Hodge, M.D.

Telemedicine At The Crossroads: Technological Innovation In A Rural Health Care Setting  James D. Campbell, Ph.D., Kimberly D. Harris, Ph.D.

Early Adoption of Practice-Based Telemedicine in Rural Health Care Settings.  James D. Campbell, Ph.D., Kimberly D. Harris, Ph.D.

Telemedicine Utilization by Advanced Practice Nurses in Rural Missouri: A Case Study  Jane Armer, RN, C, PhD

Application of the Concerns-Based Adaptation Model to the Adoption of Telemedicine in a Rural Missouri Nursing Home  Jane M. Armer, RN, C, PhD, Kimberly Harris, PhD
Background of the Project

The Rural Telemedicine Evaluation Project (RTEP) was funded through contract #N01-LM-6-3538 between the National Library of Medicine and the University of Missouri-Columbia Health Sciences Center (MUHSC) as part of NLM’s telemedicine initiative. RTEP began on October 1, 1996 and was to last three years. The major objectives of the project as stated in the proposal were:

Objective 1 - Evaluate Rural Telemedicine
Study the costs, benefits and other effects on rural health care of integrated telemedicine systems based on the National Information Infrastructure (NII).

Objective 2 - Implement Local Infrastructure and Connect it to the NII
Implement a local digital infrastructure, based on commercially available technology, linking all major components of the health care delivery system in five rural communities (Boonville, Fulton, Macon, Brookfield and Fayette, Missouri), and connecting them to the University of Missouri Health Sciences Center (MU-HSC) and to the NII.

Objective 3 - Deliver Integrated and Secure Telemedicine Services
Deliver a well-integrated and secure set of telemedicine services through the project infrastructure and the NII, including an integrated World Wide Web based interface to major telemedicine resources, health care database access, clinical information systems, email, video conferencing and other forms of telemedicine, based in part on the assessment of the specific needs of health care providers in participating communities.

Objective 4 - Support Users in Adopting Telemedicine
Provide the training, management strategies and technical support needed to enable rural health care providers to adopt and effectively utilize telemedicine services available through the NII and the infrastructure provided by the project.

Year One was set aside for planning, with implementation scheduled for years two and three. Although the original proposal included five communities, funding was available for only three. Boonville (Cooper County), Macon (Macon County) and Brookfield (Linn County) participated in the project.

RTEP was shaped by earlier telemedicine experience at the University of Missouri Health Sciences Center. MUHSC’s distance learning experience dates from the 1960’s, when it established a statewide audio education network for physicians that included over 100 local hospitals and clinics. Its work in medical informatics, started by Dr. Lindberg when a 300 baud terminal was the state of the art, is well known to NLM, and provided a base of expertise in various digital technologies and their use in health care and education. MU’s Medical Informatics Group (MIG) continued after his departure to develop further informatics capacity and to integrate informatics more fully into the medical curriculum at MU. (MIG later became a
part of MUHSC’s Integrated Technology Services, or ITS.) The statewide University of Missouri system had been using interactive digital video to connect its four campuses for educational and administrative purposes since 1986. Then in the early 1990’s Dean Lester R. Bryant, M.D., asked his staff to explore the potential of clinical telemedicine, especially as it related to the Health Sciences Center’s growing rural health care network.

Dean Bryant’s interest led to an effort to create a rural telemedicine network through a public-private partnership that included rural providers, major telecommunications companies, public schools, the Missouri Public Service Commission and the University’s Health Sciences Center. Under the leadership of MUHSC’s Associate Dean for External Affairs, this partnership developed a plan for a rural telemedicine demonstration project. Considerable effort was made to involve rural providers and tertiary specialists in its development. The companies and organizations involved were very supportive and enthusiastic, but in late 1994 the group reached an impasse. Specific funding commitments were now needed, and each member was reluctant to make a firm commitment until the others had done so.

The logjam was broken when HRSA’s Office of Rural Health Policy (now the Office for the Advancement of Telehealth, or OAT) awarded a $1.2 million three year rural telemedicine grant to MUHSC in early 1995. Although it funded only part of the planned network, the OAT grant and the substantial cash commitment of matching funds by MUHSC elicited funding commitments from the other members, including major support from Southwestern Bell, GTE and AT&T. The resulting effort involved more than $10 million in equipment, telecom services and direct funding. A rural telemedicine network with 22 sites, known as the Missouri Telemedicine Network (MTN), was the result. MTN relied primarily on interactive digital video technology, but used T1 lines to create a mixed video/data network with the thought that data-oriented telemedicine applications might be implemented in the future. Each MTN site had a \( \frac{1}{2} \) T1 video channel and an equivalent data channel linked to MUHSC’s fiber optic backbone, and from there to the internet. The RTEP communities were selected from those having MTN sites, giving RTEP both the capacity to do video telemedicine (an important form of telehealth) and significant data bandwidth connecting the community to the NII.

During the same period MUHSC’s Integrated Technology Services unit was developing resources that would soon become important parts of RTEP. STAR, a text-based patient information system, was developed during those months, and reached the stage of early beta testing as RTEP began. STAR approached its task by integrating information from MUHSC’s many existing clinical information systems, and was seen as the forerunner of a truly integrated system. (A fully integrated system was developed through a partnership of MUHSC with the Cerner Corporation and IDX, and is largely implemented at this writing.) ITS was also asked to develop a web-based interface to HSC and national information resources for the use of medical students working in rural community placements in connection with Missouri’s Area Health Education Centers, for which MUHSC is a statewide coordinating office. This interface was the basis for the RTEP Workstation, the project’s web portal for health professionals, about which more is said in the following pages. ITS was also working with MUHSC’s growing network of rural outpatient clinics to integrate them into major HSC systems, including the IDX system that handled patient appointments, billing and other functions.
As a result of this background, ITS and the School of Medicine’s External Affairs program decided that a partnership was the best way to develop and implement RTEP. Joyce Mitchell, Ph.D., Associate Dean for Integrated Technology Services and Chief Information Officer, and Weldon Webb, Associate Dean for External Affairs, served as co-Principal Investigators.

A basic RTEP objective was to make telemedicine as ubiquitous in the local health care system of each community as technology and funding allowed. The major town in each RTEP county had an MTN (video) telemedicine installation in its community hospital, and in two cases also in a local clinic. The Web portal application mentioned above (the RTEP Workstation) provided consistent, location independent access to tools such as MEDLINE, email, patient education information, and all the other resources of the Web. Because health care providers and organizations in these communities, as in most rural areas, had very little in the way of local area networks and PCs – much less wide area connections and fast internet access – RTEP provided most of these resources. RTEP was conceived as a community-based attempt to explore telemedicine as an every day tool in the delivery of rural health care.

MUHSC’s Approach to Telemedicine and its Evaluation

From its beginning in 1995, MTN included a basic evaluation effort involving regular data collection on its activities. Some of these data simply described MTN activities (a matter largely neglected by the previous generation of video telemedicine projects), but others involved questions such as travel savings by patients, access to care had telemedicine not been available, and patient/provider satisfaction. MTN data on activity in RTEP counties was included in RTEP’s evaluation data set. MTN’s first video installations occurred in mid-1995, and the initial full scale (14-site) network was up and running in early 1996.

MTN, and later RTEP, were shaped by serious concern over the slow adoption of telemedicine experienced in other projects. Visits to leading telemedicine projects, including those at the Medical College of Georgia, the University of Kansas and the Mayo Clinic, were made by MUHSC clinicians and managers in 1993 and 1994. These and other discussions with established telemedicine programs had one common theme – the difficulty of getting practicing physicians to use the systems. Information resources such as MEDLINE, powerful though they are, were not being integrated into the work of most clinicians. We discussed electronic medical instruments, video resolution and bandwidth on these visits, but what impressed us most was that clinicians were not readily making telemedicine a part of their everyday work. This was true even when a project had observed the traditional wisdom that early involvement of clinicians would ensure their interest.

This was a critical issue for MUHSC. Our involvement in telemedicine was motivated not only by academic curiosity, but also by a very practical desire to find out whether and how telemedicine could help the HSC deliver better rural health care in the growing number of communities it served. Although studies of focused applications (such as the NLM project involving telemedicine in the neonatal ICU at Beth Israel Deaconess Medical Center in Boston) are valuable, our questions involved the feasibility and value of telemedicine as a routine part of an actual rural health care system, handling a broad spectrum of everyday problems. The lack of
physician acceptance in earlier projects suggested that even when dealing with relatively established applications of telemedicine, their usability outside of narrowly focused demonstration projects was an open question.

When viewed from the perspective of a health care delivery system, telemedicine appears not as a new kind of health care, but as a medium through which to deliver care (or to conduct related activities such as information searches). That health care might be innovative or routine. Its quality might be high or low, and it might be delivered by an organization that is efficient or inefficient. But from this perspective, telemedicine itself is nothing more than a new way to do things one would do (or wish to do) anyway. It can be fruitfully studied as a set of discrete applications with the focus falling on factors like efficacy, risk, and cost. It can also be studied as a medium through which existing delivery systems might do their usual work, in which case a basic question is whether and how it can become a part of everyday health care in the first place.

It might be argued that this concern with adoption focuses on a secondary issue at the expense of the really important questions of clinical efficacy and economic impact. This view is reflected in most recent prescriptions for telemedicine evaluation. But the assumption behind these priorities is that given evidence on clinical and economic benefits, the incorporation of telemedicine into everyday health care will largely take care of itself. Such optimism is not supported by the recent history of medical informatics.

The authors were reminded of this history not long ago when viewing a black and white film made at the University of Missouri in the early 1960s. One segment featured a young Donald Lindberg, M.D., explaining the power of digital information systems to help physicians make better clinical decisions. Almost 40 years later, we are just beginning to make that vision a reality outside of a few demonstration projects. Yet the database technology behind many of these applications was available in a workable form in the 1960’s and 70’s, and so was convincing evidence of their value. The technology for digital image management developed more recently, but the core of the computerized patient record and of resources like MEDLINE is the relational database. Of course computing has become radically cheaper in recent years, but the health care system has not hesitated to implement other expensive technologies thought to be helpful in patient care or in generating revenue. Given this background, it is hard to justify the assumption that telemedicine will automatically take its rightful place in health care once it is adequately proven. Answers to the questions of whether and how telehealth can become a meaningful tool for the routine delivery of health care are far from obvious, and in the absence of such answers the findings of clinical and economic studies may remain moot for many years to come.

**Barriers to Everyday Telemedicine**

For telemedicine to have a significant effect on a community’s health care it must obviously go beyond a few special applications and must be suitable for many of the tasks involved in everyday clinical work. It must be a broad-spectrum medium. Our overall assessment of telemedicine technology as MTN & RTEP developed was that the adequacy of telemedicine for many specific health care tasks had been demonstrated.
For example, there was reasonably good evidence that some types of adult and pediatric cardiology and adult neurology visits work well via digital video.\(^{(1-15)}\) For dermatology and teleradiology there is an even larger literature.\(^{(16-47)}\) It is not a big leap to think that if one can take care of certain cardiology, neurology and dermatology patients with it, video telemedicine can also be used for diabetes follow up visits, some kinds of post-surgical follow up, high risk pregnancy consults, etc. Whenever a telemedicine project had been able to work with (or was developed by) a clinician who actually wanted to explore telemedicine’s potential, providers and patients had little trouble determining the usefulness and limits of the medium from their perspectives.

But it was very difficult to go beyond this. The few programs in which telemedicine was used as a broad spectrum tool were delivering care in special circumstances. They were either part of the military’s significant telemedicine effort or provided care to prisoners through contractual agreements.\(^{(64-85)}\) In typical US civilian health care settings, physicians were not very enthusiastic about telemedicine and utilization was low. In spite of this it was also clear that, as is often the case with new technology in American health care, attempts at broader implementation would not necessarily await research findings. A growing number of health care organizations were moving ahead with telemedicine, often for reasons having more to do with marketing than with clinical utility.\(^{(86,87)}\) This did not diminish the value of focused trials on specific telemedicine applications, but it seemed clear that studies having a broader perspective – studies that could examine telemedicine in real-world health care rather than narrow special projects – would also be of use.

In the telemedicine literature and at conferences in the field there had already been considerable discussion of the difficulty telemedicine has had in becoming a routine tool outside of narrow special projects. This was (and is) frequently explained in terms of barriers to telemedicine adoption.\(^{(88-133)}\) It was important to understand what these barriers might mean for RTEP, and it is worth a brief detour at this point to summarize the perspective that shaped the project.

Many lists of telemedicine barriers have been published and they use various terms, but they involve the following themes:

- Lack of reimbursement, especially by HCFA
- Medico/legal issues such as licensure
- Physicians are resistant to change and averse to new technology
- Telemedicine systems are not user friendly enough
- It will not be adopted until clinicians and managers have firm evidence of its value
- Telemedicine fails when providers are not adequately involved in its development

Our assessment was that these factors were not good explanations for the very low levels of adoption seen in most projects \textit{so far}. We believe that is still the case today.

**Lack of reimbursement, especially by HCFA** There is no doubt that the lack of telemedicine reimbursement by HCFA and others remains a serious problem, although at MUHSC and in many other areas most private insurers are routinely paying for telecare. If telemedicine had been adopted as a general purpose care delivery tool in specially funded projects but could not move
into normally funded settings, reimbursement might well be a large part of the explanation. But that was not telemedicine’s problem. It was stuck at an earlier stage of adoption, where it had not become a general purpose tool even in special projects where grants paid providers for non-reimbursed telecare. Several of HRSA’s projects, including the one at UMHSC, had this feature. The elimination of reimbursement constraints had not made it noticeably easier to advance adoption in these projects.

There is a large clinical service in almost every medical center for which telemedicine is useful, and in which the reimbursement issue is irrelevant even in a fee-for-service environment and even for Medicare patients. That service is general surgery. Many rural patients travel significant distances for post-surgical visits that amount to little more than a quick glance at the wound and a couple of questions about pain. The very large majority of these visits do not reveal problems requiring further treatment. Surgeons at MUHSC and elsewhere have found video telemedicine and even digital still photos sent over the internet to be an adequate basis for several common varieties of post surgical screening. These media are not adequate to treat the difficult cases, which must be seen in person, but are effective in identifying patients who really need in-person care. And reimbursement is not an issue because the cost of these visits is included in the global fee charged for the procedure, even for Medicare patients. If reimbursement was a critical barrier, surgery follow up would be one of telemedicine’s growth areas. But the process of integrating telemedicine into this service, at MUHSC and elsewhere, is no less slow and difficult than in other services.

Of course reimbursement could become a very serious barrier, but not until we reach it. It cannot explain the slow progress made so far.

**Medico/legal issues such as licensure** Video telemedicine raises difficult questions about the interstate practice of medicine and other clinical disciplines. When a physician in Maryland provides telecare to a patient in Missouri, in which state is medicine being practiced? Does telemedicine take the patient to the doctor, or the doctor to the patient? Is medicine being practiced in both states or in neither state? Medical licensure boards and state legislatures have responded in various ways, ranging from aggressive legislation to benign neglect, and the issue is far from resolved. (55-63)

No doubt this sometimes presents frustrating problems to telemedicine programs located on a state border, where providers and patients on different sides of the line might normally be involved the delivery of care. But many telemedicine projects, like MUHSC, do not have this problem to any significant degree because they are located far from the border. If licensure was a significant limiting factor, these mid-state programs would have a distinct advantage, but there was (and is) no evidence that these projects (including those that provide reimbursement from grant funds) have had a noticeably easier time of it.

There are other legal issues such as liability and credentialing, but again they have been successfully dealt with in some projects without having any apparent affect on the pace of adoption. At MUHSC, for example, malpractice coverage is provided through a self-insurance arrangement, the administrators of which have indicated in writing that physicians providing care via telemedicine are covered as fully as they are for in-person care. Credentialing has been dealt
with mainly by acquiring privileges for telemedicine providers in the rural hospitals where many of MTN’s telemedicine units are located. There was no indication that this or any other medico/legal question has been a barrier to those uninvolved in telemedicine at MUHSC, and it has not been raised as a serious concern of any of the physicians who are interested in telemedicine. These medico-legal issues are far from trivial, but they could not be telemedicine’s immediate problem.

**Physicians are resistant to change and they are averse to new technology**  This idea is not uncommon in telemedicine articles and presentations, but it would be difficult to find a profession that experiences new technology and other major changes with the speed and relentlessness seen in medicine. This is not to say that it is easy for a group with an agenda (whether it be a drug company or an Institute of Health or a telemedicine network) to create specific changes in practice behavior. It is difficult and expensive to get clinicians’ attention, and then it is necessary to convince them of the need for change. But the vast majority of physicians, urban and rural, change frequently, and once convinced that a change is desirable (whether for scientific or economic reasons), they are very difficult to stop. Change *per se* is not our problem.

**Telemedicine systems are not user friendly enough**  If the problem isn’t the physicians, maybe it’s the equipment. Physicians and other health professionals, like anyone else, appreciate well designed user interfaces. But when they believe an inconvenient and intricate task is necessary for the provision of good care (or in some cases, for favorable reimbursement) they routinely accomplish it. Concern for user friendliness does begin to speak to the problem of integrating telemedicine smoothly into health care routines, but it focuses on device and program interfaces when the problem is much broader. (More on that below.) Without denying the need for user-friendly systems, user interface defects alone could not explain the indifference of most providers to telemedicine. Most of these providers never get involved enough to care about the interface.

**It will not be adopted until clinicians and managers have firm evidence of its value**  Telemedicine authors and speakers who do not blame the equipment or the legal system or the physicians or the third parties for blocking the mainstreaming of telemedicine have still more cards to play. One that is popular among academics is the claim that telemedicine will not come into its own until we have sound evaluation studies showing providers and health care managers the value of telemedicine.

Perhaps this should be true, but American health care does not always work that way. The last few decades provide many instances in which innovations were adopted prior to the availability of firm evidence on their value. New imaging technologies have sometimes acquired a popularity not closely related to their medical and economic value, or at least to available research at the time. Obstetrical ultrasounds are a good example. (133-139) This is occasionally true even of clinical interventions. But this pattern is especially obvious with regard to innovations in the organization or funding of health care. DRGs, many of the forms taken by managed care, the remarkable consolidation of the hospital business in the early 90’s, and other important changes
in the way health care is delivered occurred in the absence of clear evidence they would make for better or more efficient care. Large and well documented geographical variations in the prevalence of common medical procedures, such as C-sections and angioplasty, also represent important health care decisions that are hardly based on biomedical or health systems research. Sometimes these patterns are market driven, other times politics may be the prime force, and sometimes scientific evidence does predominate. But such changes are not necessarily research driven.

This is no argument against sound research. Perhaps in an ideal health system such evidence would be required before any innovation becomes common, but we have managed to impose this requirement only on clinical interventions and medical devices, and then imperfectly. The record is clear that innovations can be adopted, and important variations in care tolerated, without the need for meaningful research findings. There is no reason to think this is less true of telemedicine than other innovations, many of which are even more expensive. In the real world of U.S. health care a lack of evidence could not be the main reason for telemedicine’s slow adoption.

**Provider Involvement**  One other factor frequently mentioned as the key to adoption is the involvement of clinicians in the development of telemedicine projects. Such involvement is clearly indispensable. But through our contacts with other telemedicine projects we were familiar projects that, like MUHSC, did have extensive and genuine provider involvement from the beginning, and they faced the same struggles with adoption as the others. Like the other barriers mentioned above, this important factor could not explain the prevalent pattern of slow adoption.

**Incentives and Integration**

If these reputed barriers to telemedicine do not really explain its slow adoption, what does? RTEP was shaped by the view that two interrelated factors are the key. These factors relate not to the question of why providers would reject telemedicine (the barriers) but to the question of why they would use it.

The first of these factors has to do with the incentives that operate on the individual provider in whose hands is the decision to use or avoid telemedicine for any given case. For video telemedicine there is rarely any immediate advantage to the provider. The patient may avoid travel, the provider’s institution may gain better external relations, and people who might otherwise delay necessary care might use telemedicine instead. But from the provider’s point of view it is still necessary to go into a room (whether an exam room or a telemedicine room) and conduct a visit. His or her life gets no easier if it is done via digital video. If telemedicine presents any inconvenience there are usually no immediate rewards to encourage providers to use it anyway. The only significant exception to this involves specialists who travel long distances to outreach clinics, and could reduce their trips with telemedicine. This is an important exception, but is not common enough to be the basis for broad-band telemedicine that meaningfully increases a community’s access to care.
As for telemedicine applications using information resources to help clinicians make better decisions in real time during clinical care, or even to answer those questions later, the situation is similar. For better or worse most providers have still been getting through the day without such tools. Although the internet provides valuable sources of on-line information, not the least of which are NLM’s electronic databases, busy clinicians cannot yet get prompt, clinically useful research-based answers to the questions they have while caring for patients (140,141). There is strong evidence that most physicians simply do not get answers to most of the questions they have while caring for patients (142-148). The sources they do use for answers are often inadequate (142,143,145) and the time they have for journal reading and other information gathering activities is extremely limited (143,149,150). For example, in a study by Ely et. al. (147) family physicians who pursued clinical questions that arose during patient care spent an average of less than two minutes on each question.

Computerized medical record systems provide new opportunities for reminders and for presenting links to MEDLINE and other resources at opportune moments. But this will not alleviate the limitations of those resources. Providers will continue to have unanticipated questions while caring for patients and they will still want efficient answers which do not require them to interpret multiple studies. Our on line tools are not yet able to do this and providers evidently have no compelling reason to abandon old tools that do meet their perceived needs.

The fact is that in the vast majority of cases, there are no significant incentives in a provider’s day to day life that would support routine use of most forms of telemedicine. This problem could theoretically be addressed by changing those incentives, but short of inflated reimbursement for telemedicine (which would keep it from being mainstreamed for economic reasons) this would require significant changes in the organization of health care. Change of that kind is beyond the capacity of telemedicine projects, and is certainly not a feasible precondition for the use of telemedicine to improve access for rural communities in the near future.

A lack of telemedicine incentives does not necessarily explain why a provider would avoid telemedicine, but it does explain the importance of the second factor that motivated RTEP’s approach. In the absence of strong incentives, it takes very little to discourage adoption. If a given form of telemedicine is not integrated seamlessly into a provider’s work – if it creates even a little inconvenience or delay – there is little reason to expect her to use it.

This level of integration did not exist in any of the telemedicine projects we had seen at the time RTEP was developed. To see a patient via video meant that several tasks must be done differently, by the clinician and by the office staff. Consider a patient in a rural clinic who is referred to a specialist. In the absence of telemedicine, the physician takes a minute to explain the referral and has the office staff call the consultant to set up an appointment. To have this done by telemedicine is very different. The telemedicine room at each end of the connection (and in some cases the lines between them) must be scheduled. This usually requires several phone calls and the coordination of three or four schedules (the schedules of two rooms in two different towns, and of the consultant and patient). The consultant’s routines are also interrupted. In addition to using her clinic’s normal scheduling system, her staff must make arrangements with the telemedicine network. The telemedicine room is rarely one of the consultant’s usual exam rooms, and is often not even in the same building. The medical chart, which at MUHSC is
usually put in a rack outside the patient’s exam room, has to be taken somewhere else and then someone has to remember to retrieve it. Unfamiliarity with the telemedicine equipment may slow the doctor down, but if there is a need to take more time than expected the rigid scheduling of the network may complicate things by disconnecting at the prearranged time because of other scheduled uses. None of these things are obstacles that would stop someone from doing something they really want to do, but that, we realized, is beside the point.

A similar picture emerges in the area of information resources. On-line information tools, no matter how good their output, still involve a significant interruption in a clinician’s routines, or often require the clinician to evaluate a body of evidence in order to get usable answers. The point is not that clinicians never do (or should) engage in such searching and analysis (151-153). The point is that with today’s tools they can rarely do this in real time in the middle of a busy clinical practice, or in their limited remaining time. Instead, they ask a colleague’s opinion, check the Physicians Desk Reference, or use textbooks which are often out of date (142,147). They use these sources because they are readily available, easy to use and clinicians trust them. (151,154,155,156,157,158)

Whatever one thinks of this, it is not reasonable to expect people having this pattern of behavior to go very far out of their way to use telemedicine, at least not without extraordinary incentives that would not be available routinely in real-world health care.

The major barrier to telemedicine adoption by clinicians, given the incentives and disincentives involved, is simply that it is usually too much trouble. It requires too much deviation from existing routines. Of course we knew from the beginning that telemedicine should be as convenient as possible, but that is very different from saying that it must involve virtually no change in a clinic’s usual routines. It took us a long time to see this. Some of the inconveniences involved seemed trivial – a doctor might have to walk for 90 seconds to a different part of the building to use a special telemedicine room. Or she might have to remember to take the patient’s chart along since it can’t be hung on an exam room door as usual. But in a busy clinic problems of this kind are not trivial, especially if they involve a significant number of patients. We have come to believe that a telemedicine application is unlikely to become a mainstream tool unless it is integrated into the routines of clinicians and their office staff in an almost seamless manner. The shape of RTEP is in large part a response to this assessment.

**RTEP and Integration**

For this insight to be of use in RTEP it had to be operationalized. After considerable work with providers and clinic staff, we concluded that effective telemedicine integration would usually have the following features:

- When an application provides an alternate way to complete a task (whether that be examination of a patient or answering a clinical question) it must work as well as the alternative in a large percentage of the instances in which it is used. The critical level probably approaches 80%. An application that (from the user’s point of view) does the job of
the standard alternative only about half the time is unlikely to be adopted regardless of its advantages.

- A telemedicine tool must be engineered seamlessly into administrative functions like scheduling, medical records and billing. It must be just as seamless for the office staff as it is for the clinician. “Seamless” means that the people involved can complete related tasks in the usual manner. If the task is to schedule the next visit, seamlessness means the receptionist is able to use the same appointment book or computer screen whether the follow up visit is done in person or via video.

- A telemedicine tool must be readily available at the times and places a provider would use the standard alternatives. When seeing patients in a clinic, if the provider normally picks up the chart on the way into an exam room and then sees the patient, a telemedicine visit must work the same. The tele-provider picks up the chart on the way into an exam room (one of the regular exam rooms in the usual clinic), goes into the room, and sees the patient. But the patient is on a video screen. If the telemedicine application is to provide answers to clinical questions, it must be just as available and about as quick as the PDR or whatever other resource would be used in its absence.

This approach is more specific and operational than the conventional wisdom that telemedicine has to be user friendly and convenient, which begs the question of how user friendly and how convenient. The point is not that these criteria are the only important issues in telemedicine, but that whatever other issues are resolved, a telemedicine application implemented in any other way has little chance of being mainstreamed. Of course these are ideals that cannot always be achieved with current technology (at least with a reasonable amount of money), but RTEP’s design was intended to achieve them so far as possible in three rural counties during a two-year period of implementation.

In rural communities like those involved in RTEP, most physicians and other primary care providers do not practice in only one location. They see patients in a clinic, in the hospital, at the nursing home, and perhaps elsewhere. They return calls from all these places and others, including their homes. Because RTEP communities, like most areas, are not served by a single integrated health system, a community-based approach was needed. We could not work only through MUHSC or any other single provider. We had to involve as many of the local providers and health care organizations as possible, and we had to have the resources necessary to make RTEP’s telemedicine resources readily available to them. We wanted to wire the local health care system as fully as possible. This would of course not provide a perfectly integrated telemedicine effort, but the community-based approach used in RTEP would provide opportunities for integration not otherwise available, and would produce useful experience and evaluation findings.
The RTEP Workstation

An important tool for RTEP and a valuable product of the project was the RTEP Workstation, the Web portal used by the project to give providers access to internet-based telemedicine resources. The first version of what became the RTEP Workstation was developed in order to give medical students in rural community placements better access to the same online resources available to students on campus. During RTEP’s first year of planning and development, this relatively simple web portal was refined and equipped with the capacity to present a set of resources customized to the user's identity. Logging functions needed for utilization tracking were added. We also modified the Microsoft Outlook web client to work within the context of
the Workstation. As we entered the project’s third year, priority was given to a re-write of RTEP, both to add certain features and to produce better documented code. The technical considerations involved in this new version, called RTEP Workstation II, are summarized below in the appendices by an article titled *A Distributed Telemedicine Application Based on Directory Services*. The Workstation will continue to be used at MUHSC and at its rural clinics as the primary Web portal to HSC resources for faculty, staff and students.

**Utilization Summary**

As additional background for the following discussion on RTEP’s Successes, Limitations and Plans, we have included here a few charts that will provide an overview of RTEP telemedicine utilization. These and many other charts appear with additional explanation in the section on Utilization Findings below.
RTEP Workstation users had access to many web-based resources. These included links to recommended resources, a web-based email client, on-line library access, NLM’s numerous web resources, and the rest of the World Wide Web. As the charts above and below indicate, there was a substantial amount of utilization which continued its generally upward trend as the project came to a close.
Each RTEP community also had one or more video telemedicine installations that were part of the larger Missouri Telemedicine Network (MTN). The next two charts summarize MTN activity during the project.
As these summary charts indicate, RTEP did result in considerable utilization of video and web-based forms of telemedicine, and that use appeared to be continuing its growth as the project approached its end.

**Successes, Limitations and Plans**

RTEP’s most important limitation was that its two year implementation period permitted us to study only the early stages of telemedicine adoption. Although the project did result in substantial utilization, RTEP participants told us in several ways that they had just started to use telemedicine resources for core tasks in their every day work. Dr. Campbell’s interview studies below address this point, as do some of the more detailed utilization charts included in later sections of this report. This limited our opportunities for some of the studies we had hoped to do, especially regarding clinical and economic impact, for the simple reason that one cannot study what is not yet happening.

Of course this limitation could have been overcome to the extent that the project was successful in finding ways to speed telemedicine adoption. We believe (and we suggest that the studies below indicate) that there are two major reasons the pace of adoption was not quicker:

1. **Seamless integration was constrained in part by the cost of video technology and the limitations of available information resources.**
As RTEP began, equipment for a video telemedicine site cost over $60,000, not including the $30,000 or more needed for a teleradiology system meeting ACR standards. Digital communications were also expensive. In most of Missouri’s rural communities, T1 service was the only viable digital service available for video, and it ranged in cost from $1,000 to $5,000 a month. Even with the generous support we received from HRSA and other MTN partners, and even with the additional support provided by NLM for RTEP, it was not possible to place video systems in enough locations to approach seamless integration. As the project ends, however, this picture has changed dramatically. Excellent video systems are available for under $10,000, and the broader availability of ISDN service in rural Missouri means that digital communications, though not cheap, are manageable because one need not pay for dedicated lines.

But there were parts of the project in which better integration of video telemedicine was possible, and in those areas the results support the view that telehealth can become a routine clinical tool under such conditions. The milestones narrative below describes the way scheduling, billing and other administrative tasks associated with a video telemedicine visit were engineered into MUHSC’s systems to the degree that a telemedicine visit was managed in a way virtually identical to that of an in person visit. We believe this was a very important RTEP accomplishment that will continue to produce benefits in the future. We also installed video telemedicine systems in two exam rooms of a new ambulatory care facility opened at MUHSC in 1996. One of these areas was used by dermatology clinics. The chief of dermatology was spending considerable time traveling to outreach clinics and had a clear understanding of the importance of outreach to MUHSC. As a result, we focused on that service as a demonstration of seamless integration of video telemedicine. Both administratively and from a clinician’s point of view, a dermatology visit was handled in the same way whether or not it was done in person, with the one exception that when the physician entered the exam room he might see the patient on a screen instead of in the flesh. As the utilization data indicate, telemedicine has become a routine part of the delivery of health care by this service to rural patients. A similar approach was taken in psychiatry and cardiology, though an optimal number of video systems could not be installed in their clinics. Psychiatric telemedicine was fostered by a contract with a regional mental health network, which provided a built-in demand for telecare that did not require any initiative on the part of our psychiatrists or their staff. Cardiology also showed relatively good utilization levels, but not as good as dermatology’s. This was due in part to major turnover in the cardiology faculty. In general, video telemedicine was adopted as an everyday tool to the extent that it was well integrated into the existing routines of care. Outside of those areas, its use was relatively sporadic.

Partly in response to these findings, MUHSC is in the process of replacing older systems with compact inexpensive video systems that use ISDN instead of T1 lines. This is making it possible to:

- Put systems where they are needed, since they are an order of magnitude cheaper and smaller.
- Give users better control over connections – any system can call any other system at any time.
• Reduce staffing costs since scheduling and managing the T1 network is no longer necessary.
• Control telecom costs by avoiding dedicated lines.
• Migrate management of video telemedicine infrastructure from a special project to the HSC’s usual technology managers, making it just another part of the HSC’s infrastructure.

Taken along with the work already accomplished by RTEP in making video telemedicine an integral part of our clinical systems (both digital and human) we believe this will produce a very marked increase in the routine use of video for patient care. We make this point not primarily because it highlights the value of RTEP for MUHSC (though it does that). We wish to emphasize this aspect of the project because we believe it is an important demonstration that a lack of seamless integration is in fact the most important barrier to rural telemedicine. MTN evaluation studies will continue to study the effects of these changes on the usefulness of video telemedicine as a routine tool for MUHSC and our rural patients. Future publications based on the RTEP experience will disseminate these views.

With regard to information-oriented applications such as clinical decision support, hardware was less of a problem. Thanks to NLM we were able to put enough workstations in enough places to make such resources available almost everywhere a clinician might need them. When a provider demonstrated a particular interest, we were willing to add workstations or in a few cases a laptop computer to further improve access. The problem here was not scarce equipment but the fact that available applications did not work well enough from providers’ points of view. This is evident from the findings of Campbell’s interview study included below. Valuable as MEDLINE and other digital information sources have been, they do not yet provide the kind of real-time support these providers need. Or to put it another way, they do not work well enough to seamlessly replace providers’ standard resources, even when the availability of current applications is nearly ubiquitous. Dr. Campbell’s interviews also demonstrate the absence of any significant incentives (in the view of the providers) to choose digital resources over existing methods.

MUHSC is responding to this by focusing on an effort to create improved tools of this kind. This project, called the Family Practice Information Network (FPIN), was initiated by Bernard Ewigman, M.D., of our Department of Family and Community Medicine, and has drawn the interest of several prominent family medicine researchers at other institutions, as well as that of the American Academy Family Practice. FPIN draws on evidence-based medicine as a key way to organize medical information for clinical decision making, and is implementing web-based and wireless portals to a system that provides information resources clinicians will use. Although we were recently unsuccessful in acquiring additional NLM funding for the project, we are pursuing funding from other sources. We see FPIN as the logical successor to RTEP in the sense that it addresses the limitations that prevented more successful integration of RTEP’s information tools into rural health care. The RTEP network is expected to serve as a valuable test bed for FPIN as it develops.
2. User training and support was not adequately focused on seamless integration.

RTEP had a good user training and support staff but their activities were not sufficiently directed toward integration. Training focused on topics such as how to use Windows, how to search MEDLINE, and how to use a browser. Members of the staff with a background in libraries eagerly helped users access on-line information resources. Project staff members made themselves available very quickly and conveniently to help users with problems; we placed staff members in each community for this purpose. These measures were necessary, but not sufficient.

In a sense, the problem was that we relied on RTEP users to envision the benefits of telemedicine applications in their daily routines. But by definition these were the people who didn’t know much about telemedicine. On the other hand, we had staff members who were knowledgeable about digital information resources and technology, but they could not know enough about the work of our various users to identify specific, concrete and seamless ways in which telemedicine resources could help. That sort of integration depends not on general principles and visionary ideas, but an understanding of the moment to moment details of a person’s work. In an ideal world these two bodies of knowledge would have found one another and bred synergies, but two years is evidently not a sufficient period for much of that to occur. We needed to take more active measures to bring them together.

One way to do this might be to educate users about the value of telemedicine resources, and we certainly did attempt this. But it is unrealistic to expect most people, in the course of trying to get through the week, to integrate a new body of knowledge and creatively visualize innovative ways to apply it. This might occur eventually, but not very often, as we said, in the first two years.

The other way to approach the problem would be for the telemedicine experts— the project staff—to get sufficiently involved in the details of users’ everyday work that both could understand opportunities for, and help implement, seamlessly integrated telemedicine applications. We tried this to some extent during the third year by having staff members spend a few days at each RTEP work site and identify potential uses for the project’s applications, but a more systematic and intensive approach was needed. We needed a more coherent way to analyze the work processes at RTEP sites and we needed to have sufficient staff members focused on the adaptation of telemedicine applications to those processes (not the adaptation of work processes to telemedicine). MUHSC’s ITS department developed a method for work-flow analysis in the process of building our new information system, and we hope to adapt it to rural telemedicine applications in the future.

We do not suggest that an effort of this kind is necessary wherever telemedicine is to be used. We did observe important instances of telemedicine integration, such as those involving Loch Haven Nursing Home and the Quaranto practice in Macon. But in a project hoping to observe as much telemedicine activity as possible as quickly as possible, measures of this kind are needed to hasten the pace of adoption. Their use in RTEP would have provided more opportunities for evaluation studies.
Additional areas of success for RTEP included:

- **The RTEP Workstation**, now implemented in version 2, will continue to serve as a portal for health professionals to digital resources. It is expected to be the primary interface for rural providers to interact with HSC digital resources.

- **RTEP’s impact on participating communities** was significant. Local providers and health care managers said repeatedly that the project’s Community Advisory Groups produced greater communication and cooperation within the local health care community than they had ever previously experienced. Computing became commonplace in health care facilities where computers and networks, if they existed at all, were sequestered in one or two administrative offices. The stage has been set for additional telemedicine adoption as better applications become available. In addition, at least two of the communities are pursuing additional funding to maintain the local telemedicine infrastructure.

- Although more adoption would have been better, the **levels of utilization were very substantial** and showed very distinct upward trends through the end of the project. Successful telemedicine applications involving Loch Haven Nursing Home, the Quaranto outpatient clinic, the holter monitor application, and several others did develop as a result of RTEP and will continue to function for the foreseeable future.

- RTEP studies have already resulted in several **publications**, and several more are expected in the coming year.

- We hope to be able to complete the Loch Haven Nursing Home study on responsiveness to patient problems.

At the time RTEP was developed we were not aware of any other project using a community-based approach of this kind to investigate the real-world implementation of telemedicine, and that is still the case. RTEP produced substantial and still-growing levels of utilization, especially considering the limitations of a two-year implementation period, along with useful initial findings about the integration of telemedicine into everyday rural health care. The project laid a foundation for even more meaningful studies and for more effective integration in the future. RTEP communities present a unique opportunity for telemedicine field studies addressing the question of how telemedicine can best be used to improve rural health care. MUHSC will continue to work for the additional funding needed to build on RTEP’s accomplishments.
Citations


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RTEP – MAJOR MILESTONES AND WORK PLAN

The following narrative of major RTEP milestones, along with the work plan that follows, provide a good sense for the development of the project.


• Cooper County was selected as the pilot site for the development of the Rural Telemedicine Evaluation project. The selection of this site was important because it was approximately 25 miles from the MUHSC thus keeping travel time for the staff implementing the pilot network at a minimum. Using a more distant site would have required excessive travel at this point in the project.

• Key technical, administrative, and clerical personnel were hired or had their existing time commitment altered between October 1996 and March 1997. These include the following. [Percent FTE shown in ( )]

- Project Director (.50)
- Evaluation Coordinator (.40)
- Planning/Implementation Coordinator (.40)
- Sr. Computer Programmer Analyst (.25)
- Information Resources Coordinator (1.0)
- Computer Programmer Analyst II (1.0)
- Administrative Assistant (1.0)
- Network Support for the Boonville (1.0)
- Assistant Director (.50)
- Information Technology Coordinator (.25)
- Computer Programmer Analyst II (.50)
- Sr. Computer Programmer Analyst (1.0)
- Project Development Specialist (1.0)
- Sr. Health Program Specialist (1.0)
- Administrative Assistant (1.0)

• Healthcare facilities and staff identified in the proposal from the Cooper County area were brought together for an informational meeting to discuss the project and establish a community advisory group for this area. The Community Advisory Group (CAG) would provide the local/rural input needed to guide the project throughout its life.

• Project directors, managers and coordinators developed a schedule for weekly meetings with the co-PIs meeting on a monthly basis with the group. The purpose of these meetings was to keep the project on its intended time line, deal with problem issues, and plan for Phase II. These meetings were eventually moved to biweekly during the later stages of Phase I.

• The Evaluation Director set up initial and recurring meetings with the various evaluators who would be working on the project. These meetings included areas from nursing, family medicine, health economics, and information technology services. For the purpose of understanding network utilization an automatic data tracking system was designed to record Internet and e-mail traffic.

• An analysis of computer resources within each facility was conducted to decide what existing technologies would need to be replaced and which would meet the selection criteria outlined by the project staff.
• A baseline assessment of information seeking behaviors was conducted by the Information Resources Coordinator to ascertain the way physicians and other clinicians were accessing health-related information either electronically or by other means.

• Frame Relay telecommunication services were selected to provide network connectivity. This service was not available at the time of the initial proposal. However, reconfiguring the network using this service not only meant less expensive monthly telecommunication charges but also negated the need to set up an expensive router hub at the Cooper County Memorial Hospital (CCMH). The frame relay network would make better use of the public telecommunications network and make adding network sites much easier. This meant that each network site’s telecommunications access would terminate in a public facility and be routed to the University of Missouri Health Sciences Center (MUHSC) as opposed to each site being routed to CCMH and then subsequently routed to the MUHSC. Overall this design reduced the number of failure points within the network and reduced the overall cost which allowed for the expansion of the network into healthcare sites (i.e., nursing homes) beyond those originally proposed.

• Computers, network routers, network servers, software, cabling, telecommunication services, etc., were purchased and installed during this phase. The first non-University owned network connection from the Cooper County area back to the University of Missouri was established April 1997. Below is a table of sites who chose to participate and provides information on the number of PCs and printers deployed at each site. The table also provides information on those sites who chose not to participate.

<table>
<thead>
<tr>
<th>Cooper County/Boonville Area</th>
<th>Networked PCs</th>
<th>Servers</th>
<th>Printers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cooper County Mem. Hosp.¹</td>
<td>22</td>
<td>1</td>
<td>8</td>
</tr>
<tr>
<td>University Physicians²</td>
<td>9</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Dr. John Ward ³</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>County Health Dept/Nursing Svc.</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>New Franklin Clinic</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Katy Manor Nur. Home³</td>
<td>2</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Heart of MO Counseling Ctr.</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Lakeview Nursing Home⁴</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ashley Manor Care Ctr. (Nursing Home)⁴</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Riverdale Care Center (Nursing Home)⁴</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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1 Including 4 PCs purchased by CCMH (two PCs & 1 printer - home health bldg.)
2 Including 7 PCs purchased by University Physicians
3 Including 1 PC purchased by Katy Manor
4 Declined to participate
5 Relocated to Dr. K. Beauchamps in Macon.
• Three nursing homes in the Boonville area declined to participate in the project. Reasons for their non-participation include being itinerantly owned/managed, concerns over the security of the network, and the belief that participating in the network may give others using the network the ability to access the confidential information of each facility.

• A Rural Telemedicine Evaluation Project (RTEP) fact sheet was developed to answer frequently asked questions by the rural sites and the media. A newsletter was also created to send to Phase I and Phase II sites to keep each site informed about the progress of the project.

• The RTEP Workstation, a user friendly and customizable web based interface entered the development stage in the later part Phase I. The underlying principle behind the design of the workstation was to create a practical site that would meet the majority of each user’s needs. The site needed to be static in the sense of providing each user a stable environment but dynamic in constantly providing up to date health related and other information.

• The web client for Microsoft Outlook was found to be deficient in terms of providing an e-mail directory of users. The programming staff had to create a custom directory of users that would link back to the e-mail client.

• The Sr. Health Program Specialist (SHPS) began a formal training program for general PC usage, e-mail, Netscape and navigating the Web. Netscape Navigator was selected as the web browser of choice.
• The MTN video network was used to conduct biweekly meetings between the project directors, SHPS and Network Support Specialist. This reduced costly and time-consuming travel while creating a increasing staff productivity through better time management.

• Initial meetings of healthcare sites in the Phase II communities of Macon and Linn Counties began in Phase I as part of the planning process. Additionally, an open house for the health professionals in these Phase II communities was held at CCMH as a way of promoting the success of the network in the Cooper County area.

• Based on the experience in the later stage of Phase I, it was recognized that a SHPS and a Network Support Specialist (NSS) would be needed in each community. This required an additional three FTEs be added to the project (2 SHPS and 1 NSS). These FTE’s would be necessary in order to meet the Phase II objectives.

• The first of two community image assessments of the three project communities was conducted. These assessments were conducted to ascertain how the development of high speed computing technologies might impact the perception of the local healthcare facilities.

• Users were provided with access to the MUHSC Library for the purpose of searching for articles and ordering reprints of requested documents.

• Per the requirements of the contract a Phase I Final Report was sent to NLM detailing the Phase I experience, providing an implementation plan, training plan and budget for Phase II.

**Phase II: Implementation – October 1997 – January 2000**

• Additional full time staff was hired in the first three months of Phase II to support the planned expansion of the project. These positions included:

  Network Support Specialist – Brookfield  
  Sr. Health Program Specialist – Boonville  
  Administrative Assistant

  Network Support Specialist - Macon  
  Project Development Specialist

• Based on the Phase I experience, computers, network routers, network servers, software, cabling, telecommunication services, etc., were purchased and installed for all Phase II sites within 6 months of the start of this phase. Below is a breakdown of the equipment provided to each site in each community.

<table>
<thead>
<tr>
<th>Macon County Area</th>
<th>Networked PCs</th>
<th>Servers</th>
<th>Printers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Samaritan Memorial Hospital</td>
<td>26</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>Dr. Deline and Campbell</td>
<td>2</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Dr. Julie Wood</td>
<td>2</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Macon County Health Dept.</td>
<td>2</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Dr. Alyce Tyree</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Loch Haven Nursing Home</td>
<td>14</td>
<td></td>
<td>5</td>
</tr>
</tbody>
</table>
University Physicians - Macon
1 Includes 10 PCs and one AS400 system (server) purchased by SMH.
2 Includes 1 PC that Dr. Wood has provided.
3 Includes 4 PCs purchased by Loch Haven.
4 Includes 2 PCs provided by UP Clinic.
5 Includes 6 PCs provided by the Northeast Missouri AHEC.
6 Chose not to participate due to frequent administrative turnover resulting in the inability to obtain a commitment from this site.
7 Reallocated from Dr. Ward's office in Boonville.

<table>
<thead>
<tr>
<th>Linn County/Brookfield Area</th>
<th>Networked PCs</th>
<th>Servers</th>
<th>Printers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pershing Memorial Hospital ¹</td>
<td>24</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>Marceline ²</td>
<td>9</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>UP - Brookfield</td>
<td>3</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Drs. Rivera / Rivera-Concepcion</td>
<td>1</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>McLarney Manor Nursing Home</td>
<td>2</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Maranatha Manor</td>
<td>2</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Linn County Health Dept and Home Health</td>
<td>3</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>Dr. William B. Copple, DDS</td>
<td>1</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Linn County Ambulance</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pioneer Nursing Home</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dr. Michael Crist³</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lifecare Nursing Center</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1 Includes 8 PCs provided by Pershing (four in the hospital and four in the Annex Building.)
2 Includes 5 PCs purchased by University Physicians
3 Dr. Crist and the Lifecare Nursing Center chose not to participate

- Sr. Health Program Specialists hired during this phase worked very closely with the Sr. Health Program Specialist hired in Phase I. This was planned so that the new SHPS could be brought up to speed on the training program to be established in Macon and Linn counties.
The community advisory groups for all three communities met monthly during this phase of the project. The goals of the group were to work together with the RTEP staff to brainstorm and customize the project to meet the needs of each group and to foster an atmosphere whereby the groups would begin to assume responsibility for the project and its sustainability beyond the contract period. Activities of these groups included:

- Discussions on fostering the use of e-mail between all healthcare sites to help reduce phone tag between parties.
- Discussions on acceptable use policies for the network
- Updates and questions regarding training and technical support updates
- Develop ideas for programs that would benefit from the use of the network. These include:
  - Transmission of wound images between sites using still digital images
  - Electronic ordering of ancillary tests
  - Ancillary test reporting
  - Use of mailing lists to stay current on issues impacting healthcare and specific institutions (e.g., nursing homes, hospitals).
  - Ordering of reprints from medical libraries
- Receiving updates from the RTEP staff on the progress of the project overall
- Seeking proposals from Internet Service Providers in an effort to continue the operation of the network beyond the contract period.
- Cooperative ventures in the submissions of proposals for future outside funding

Bi-weekly meetings of the RTEP staff via videoconference were held with the project’s Director and Medical Director. The purpose of these meetings was to share information and provide direction to the staff working in the remote areas.
The RTEP enrollment kit was developed in this phase. This kit provides all necessary informed consent forms for participating in the studies and user information for an RTEP Workstation account. The MUHSC IRB approved the enrollment kit for use in this project.

The development of the RTEP Workstation continued in the early part of Phase II with the roll out of the product occurring within the first six months. The Workstation would include the following:

- **Login Page** – users would enter a unique ID and password before gaining access to the network. The system was designed so that only one would be needed to gain access to the network and all of its features, including e-mail.

- **Announcement Page** – This area provides updated and useful information regarding network activities and current healthcare news. It is updated daily by the Sr. Health Program Specialists.

- **E-mail**

- **Websites** – This area would be used for providing recommended health related websites to the users which would be updated periodically, and also allow users to store their favorite sites.

- **My Workplace** – This section would provide a space for each participating institution to develop their own website and/or provide information to their employees (i.e., computer usage policies).

- **My Community** – This would contain information specific to events happening in the local area.

- **Search** – This area provides access to all of the popular search engines and to the MUHSC library.

- **Health Care** – This area would provide access to the electronic consult service with key MUHSC physicians, STAR and the MUHSC Health Information Center. Access to STAR is restricted only to those who have been approved for access.

- **Add Favorites** – An area provided for users to easily add their favorite websites to their database.

- **Feedback** – This area allows users to send feedback to the RTEP staff.

- **Configure** – Allows users to change their passwords and personal information for RTEP access.
Help - this section provides help for using the features contained in the RTEP Workstation.

Logout – Allows the user to logout of the workstation (automatically happens with 30 minutes of inactivity).

- Sample screens of the RTEP Workstation are provided on the following pages.
Health Information Center

The Health Information Center, established in 1988, recently opened in its new location in Columbia Mall's J.C. Penney wing. Staffed by registered nurses, the center focuses on maintaining and improving health through a variety of programs, services, health screenings and classes. These activities cover early detection of medical problems, self-management of chronic disease and weight counseling. More importantly, nurses take the time to listen to concerns, provide personalized health information and answer health-care questions in person, by phone or through the Staff for Life On Call Online.

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- Doctor’s Guide to Medical Conferences and Meetings
  5,000 events in over 83 countries searchable by medical specialty, location, and date. Provided by PHSI, Media and through drug company sponsorship.

- Health and Medicine in the News
  Summaries of recent articles on medical topics in the New York Times and the Minneapolis Star Tribune.

- Medical and Scientific Internet News Resources
  Provides quick access to a variety of medical and scientific news sites on the Web. Maintained by the Falk Health Information Library.

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To search for a generic or brand name drug, enter all or part of its name. Enter just 1 or 2 characters for a list of drugs beginning with those characters.

Search
• In addition to providing individual e-mail accounts, location email accounts (such as a nursing home nursing station or physician’s office) were established to encourage the use of email rather than phone messages for routine communications between departments and offices as opposed to individuals.

• The Sr. Health Program Specialists (SHPS) began a formal training program for all RTEP users. Basic training included, but was not limited to, the following:
  
  ➢ Computer literacy and Windows 95 introduction - becoming familiar with the functions of the PC, customizing the Desktop, creating files, creating shortcuts, accessing the RTEP network.
  
  ➢ Introduction to Netscape and the Internet - basic functions, searching the Internet.
  
  ➢ Introduction to email - sending messages, etiquette, attaching files.
  
  ➢ Using the RTEP Workstation - navigating the web site, accessing clinical applications, searching the U.S. National Library of Medicine databases, using Internet Grateful Med and PubMed, etc.

  In addition to the training programs conducted by the SHPS they were also a resource for the sites to call upon if an informational need needed to be met. Each SHPS helped coordinate the community advisory group meetings; regularly visited with each site in their respective area to help instruct the staff on how the network could help them within the context of their operation (i.e., acquiring patient education and other health related information); added information to the RTEP workstation’s announcements page; and kept the list of health related web site links on the RTEP Workstation current. In summary, they were an on-going resource to each site in the project and in addition to providing regular coverage at each facility could be called upon at anytime by any site.

• The Network Support Specialists (NSS) in the project managed the connectivity between and within the RTEP sites. They performed proactive and reactive maintenance on the network, PCs, printers and all other equipment provided by the project. In summary, they were the installers of the initial network and the front line technical support for the entire network after that point.

• In June 1998, Elliot Seigel, Ph.D., Michael Ackerman, Ph.D., Richard Banvard and Mary Adamik from NLM visited with the RTEP project staff for the purposes of reviewing the progress made in the project to that point.

• An IBM RISC 6000 for the System for Text Archival and Retrieval (STAR) was installed in this Phase. STAR is a JAVA based electronic patient information system which contains lab reports, xray reports, discharge notes, and other patient related information on patient’s cared for at the MUHSC. One of the goals of RTEP was to provide rural based physicians with access to STAR so that they could easily track the status of the patients they referred to the University.
• STAR was made available to University Physicians practicing in the project communities during this phase. However plans to roll out STAR to non-University Physicians in this Phase would not occur due to delays in the approvals needed from the MUHSA Electronic Medical Record Committee, Security and Confidentiality Committee and MU legal counsel. As of this writing the University attorneys are reviewing the final documents (STAR account application, clinician use and acceptance forms, patient consent forms) before STAR can be provided to non-University clinicians. It is expected that STAR will be available to non-University clinicians about 2 to 4 months after the project ends.

• During this phase several new servers were added to the project because of the demands placed on the older/original servers. These included a server to house the abundant amount of data collected on web hits and e-mail, a production server for RTEP, and a new development server for RTEP.

• During this phase the IDX system used for the scheduling and billing of face-to-face patient encounters was programmed to do the same for telemedicine encounters. This was an extremely important step in integrating telemedicine into the existing information system infrastructure rather than developing a new system to handle telemedicine encounters. The following departments within MUHSC worked for over a year to program the integration from an information systems and logistical standpoint:

  • Telemedicine
  • IDX Scheduling staff & programmers
  • IDX Billing and Collections staff & programmers
  • Referral Services
  • Medical Records
  • Clinical and administrative staff members from key departments using telemedicine (e.g., dermatology, psychiatry, cardiology).

Developing this structure was complex from both an information system and logistical standpoint because resources (e.g., people, rooms) had to be reserved at two separate locations for telemedicine as opposed to reserving resources at only one location for a traditional face-to-face encounter. Generally the scheduling and handling of telemedicine encounters flows as follows:

- The referring provider calls the MUHSC referral service department via an “800” phone number and schedules the encounter in the same manner as he/she would for a face-to-face encounter. The Referral Services staff enter the appointment into the IDX scheduling system, and verify the availability of all necessary telemedicine resources. In cases where the referring provider is part of an MUHSC owned clinic, the scheduling system can be accessed directly and the call to Referral Services can sometimes be avoided.
- The patient is contacted with the appointment information according to the same procedures that would be followed if the visit were to be in person, with the exception that special instructions are given as to the location and nature of the telemedicine encounter.
The telemedicine staff checks the IDX clinic schedules for new appointment information at least twice daily. The referral services staff notify the telemedicine staff immediately of appointments that are added to clinic schedules with less than 48 hours lead time.

As new appointments are noted, the telemedicine staff adds the specific connection information for individual patient encounters within the network time already reserved for each clinic. Forty-eight hours prior to each clinic, the telemedicine staff contacts each scheduled telemedicine site to confirm the schedule for the room and staffing (original contact was made by the Referral Services staff at the time the appointment was made). The telemedicine staff also provides similar schedule information to the appropriate MUHSC department staff so that medical charts can be ordered and the physician’s scheduled confirmed.

On the day of the visit all encounter forms and medical records are delivered to the MUHSC clinic in the same manner as if the patient were scheduled to be seen physically face-to-face.

The patient is seen via telemedicine by the MUHSC specialist. Any necessary follow up visits, whether they are to be conducted via telemedicine or as an in-person visit, can be immediately scheduled via access to the IDX scheduling system within the telemedicine clinic room.

If ancillary tests or services are needed they are generally performed at the patient site. If test results are available during or before the encounter they can be FAXed directly to the telemedicine clinic room.

Prescriptions necessary for the treatment of the patient are either telephoned or FAXed directly from the telemedicine room to the patient’s pharmacy.

Following the initial training of the users in the project communities, the Sr. Health Program Specialists set up a schedule whereby they would rotate visits to each site during the remainder of Phase II. This schedule would allow each SHPS to interact with the local healthcare staff within their respective environment. This provided needed information to the RTEP staff in terms of how each respective site operated so that they could provide the appropriate assistance in educating the users on how they could integrate the use of the computer network into their everyday work routine.

During this phase of the project Samaritan Memorial Hospital (SMH) staff found a new way to save money and take advantage of the RTEP workstation for the capture, delivery and reporting of holter monitor data. Faced with upgrading their holter monitors and systems/software to analyze the data, SMH decided to go with a new monitoring system. This new system uses holter monitors with PCMCIA cards that capture data directly from the monitor. The PCMCIA card is then loaded into an RTEP Workstation, data from the card is then selected (user can select certain criteria for analysis) and delivered via e-mail to a third party for analysis. The analysis is then returned via e-mail within 24 hours.

In this process SMH has out-sourced the analysis of the data which saved them approximately $10,000 for an analytic software upgrade and also saves them 1.5 to 2 hours of staff time per scan. This was time the current staff spent in analysis with a cassette type program.
The fact that the RTEP Workstation has an e-mail system capable of handling large attached files has played an important role in this process as the scanned data file is typically between 7 to 9.5 megabytes in size.

- The Loch Haven Nursing Home began a pilot program of sending still digital wound images via e-mail to various physician offices within the Macon community for interpretation. The e-mails with the attached images did not contain any patient related identifiers. Rather when the images are received follow-up via phone conversations take place regarding the patient and the images. Patient related information and identifiers will not be used until such time that a secure and encrypted e-mail system can be designed for this use.

- An electronic consult service was set up during this phase. This service provides a mechanism by which a rural clinician can ask for a consultation with a specialist via e-mail. The specialists providing these consults agreed to respond to the rural clinician within 48 hours of receiving the consult information. The following specialties have agreed to provide consults in this manner: general surgery, trauma, geriatrics, child abuse, fetal and maternal health, obstetrics and gynecology and pediatrics. No direct patient identifiers are used in this process.

- The RTEP Workstation was made available to the Area Health Education Center (AHEC) preceptors who are working with medical students in various rural locations in Missouri. The students involved with the AHECs also have access to the RTEP Workstation.

- During this phase the evaluation Director and Evaluation Team continued their work on a multitude of studies. The results of this work are provided in this final report.

- Three new state of the art web servers were installed near the end of Phase II. These servers will continue to support the RTEP Workstation and the content provided via that workstation into the foreseeable future.

- A new version of RTEP was developed during the later stages of Phase II. It is expected that this version (RTEP II) will be deployed just prior to the end of the contract period.

- At a minimum the RTEP Workstation will continued to be maintained for use with the University Physicians Clinics in Macon, Boonville and Brookfield, and it will also be used by other UP Clinics and the AHECs. All other current RTEP sites may also continue using the Workstation provided they have made alternative arrangements for continued Internet service and have agreed to any new user agreement to be developed.

- Near the end of this phase of the project the co-Principal Investigators asked NLM for a no cost to the government extension for RTEP. That extension was granted by NLM which pushed the conclusion of the project to January 31, 2000.

- The final few months of the project were marked by activities relating to the planned close of the project. These activities included:
Alerting each site of the contract’s end on January 31, 2000;
Thanking site for their participation;
Providing the site with information on what equipment they will retain after the project ends and what equipment may be picked up by the Telemedicine staff;
Informing each site that the agreement for data collection would end on February 1, 2000 and that new agreements for continued use of the RTEP workstation would be required; and
Notifying the RTEP staff of the project’s conclusion and providing them with any available option for continued employment.

RTEP Final Workplan Update - University of Missouri Health Sciences Center

Phase I Administrative Objectives

Phase I Administrative Objective 1 - Recruit and hire staff for Phase I
All key staff members already working for MU-HSC and will begin working on this project on the first day. Recruitment of additional staff will begin immediately.
- Planned Start: October, 1996
- Started: October, 1996
- Target Completion Date: February, 1997
- Completion Date: April, 1997
- Primary Responsibility: Joe Tracy
- Comments: The Sr. Secretary position may not be filled.

Phase I Administrative Objective 2 - Recruit staff for Phase II
- Planned Start: June, 1997
- Started: August, 1997
- Target Completion Date: September, 1997
- Completion Date: September, 1997
- Primary Responsibility: Joe Tracy & Sue Becklenberg
- Comments: All offers for Phase II positions will be made no later than September 15.

Phase I Administrative Objective 3 - Submit Quarterly Reports to NLM
- Planned Start: January, 1997
- Primary Responsibility: Joe Tracy, Sue Becklenberg, and Linda Cooperstock
- Comments: Quarterly reports will be submitted per the contract.

Phase I Administrative Objective 4 - Develop detailed budget for Phase II.
- Planned Start: March, 1997
- Started: June, 1997
- Target completion date: August, 1997
- Completion Date: August, 1997
- Primary Responsibility: Sue Becklenberg
- Comments: Changes in Phase I spending will impact the Phase II budget. As such Phase II Budget completion is slated for August, 1997 and will be completed per the Contract.
Phase I Administrative Objective 5 - Convene meetings of key project staff approximately weekly.
Planned Start: October, 1996
Started: October, 1996
Completion: On-going
Primary Responsibility: Joe Tracy
Comments: Meetings being held as planned. Co-PIs attending monthly.

Phase I Administrative Objective 6 - Complete administrative component of Site Development Plan for Phase II sites.
Planned Start: January, 1997
Started: July, 1997
Target Completion Date: August, 1997
Completion Date: August, 1997
Primary Responsibility: Joe Tracy
Comments: Initial start date for this activity was not realistic. Need to begin outlining all administrative steps taken in phase I. New start date July 1997.

Phase I Administrative Objective 7 - Place orders necessary for Phase II infrastructure deployment.
Planned Start: April, 1997
Started: December, 1996
Target Completion Date: September, 1997
Completion Date: 
Primary Responsibility: Joe Tracy, Sue Becklenberg
Comments: Infrastructure deployment underway.

Phase I Implementation Objectives

Objective 1 - Evaluate Rural Telemedicine

Study the costs, benefits and other effects on rural health care of integrated telemedicine systems based on the National Information Infrastructure (NII).

Phase I Implementation Objective 1.1 - Meet with NLM and other awardees to develop evaluation plans.
Planned Start: First Quarter
Started: January, 1997
Target Completion Date: to be determined by NLM
Completion Date: To be determined by NLM.
Primary Responsibility: Joyce Mitchell, Weldon Webb, Barry Kling
Comments: Evaluation Coordinator and Project Director learned that evaluation activities will not require OMB approval and could therefore proceed.
Phase I Implementation Objective 1.2 - Develop and conduct initial needs assessment studies and establish arrangements for on-going needs assessment.
Planned Start: January, 1997
Started: January, 1997
Target Completion: March, 1997
Completion: April, 1997.
Primary Responsibility: Barry Kling and Gene Worth
Comments: Completion expected in April 1997. Results to be included with final report.

Phase I Implementation Objective 1.3 - Automated activity reporting measures developed, tested and implemented.
Planned Start: January, 1997
Started: March, 1997
Target Completion: March, 1997
Completion: Auto Reports - September 1997
Primary Responsibility: David Witten
Comments: Statistics from proxy server are now being gathered automatically. Auto reports being designed. UPDATE 2nd Quarter Phase II - The Microsoft Exchange package is now in place and new “auto reports” are being designed.

Phase I Implementation Objective 1.4 - Develop detailed evaluation plans for Phase II.
Planned Start: January 1997
Started: January 1997
Target Completion: May, 1997
Completion: August, 1997
Primary Responsibility: Barry Kling
Comments: Evaluation plans are now being finalized. Detailed evaluation plans were developed and submitted at the end of Phase I.

Phase I Implementation Objective 1.5 - Collect baseline data as needed for studies to be completed during Phase II.
Planned Start: March, 1997
Started: March, 1997
Target Completion: September, 1997
Completion: September, 1997
Primary Responsibility: Barry Kling
Comments: Baseline data have been collected for those studies requiring data before the beginning of Phase II - mainly the ER Transfer Study, the Community Image Surveys, and the MTN Data System.

Evaluation studies of security measures was removed from the plan per the Best and Final offer. Therefore the following objective is included only for informational purposes.
Phase I Implementation Objective 1.6 - Develop plan to evaluate automated security measures for remote access of clinical information and implement it in pilot community.

Phase I Implementation Objective 1.7 - Convene Evaluation Team Meetings approximately monthly.
   Planned Start: October, 1996
   Started: December, 1996
   Target Completion: On-going
   Primary Responsibility: Barry Kling
   Comments: Evaluation Team is meeting on a monthly basis.

Objective 2 - Implement Telemedicine Infrastructure and Connect it to the NII
Implement digital infrastructure, based on commercially available technology, linking all major components of the health care delivery system in three rural communities (Boonville, Macon, and Brookfield, Missouri), and connecting them to the University of Missouri Health Sciences Center (MU-HSC) and to the NII. Provide the central computing and telecommunications resources, such as a project Web server, necessary to provide telemedicine services through the local infrastructure.

Phase I Implementation Objective 2.1 - Place order for project Web server and other computer equipment needed for project staff.
   Planned Start: October, 1996
   Started: October, 1996
   Target Completion: October, 1996
   Completion: November, 1996
   Primary Responsibility: Joe Tracy and David Witten

Phase I Implementation Objective 2.2 - Bring project Web server on line.
   Planned Start: December, 1996
   Started: December, 1996
   Completion: February, 1997
   Primary Responsibility: David Witten
   Comments: Completed

Phase I Implementation Objective 2.3 - Develop Site Development Plan for pilot infrastructure deployment in hospital and MU-HSC clinic in Cooper County (Boonville).
   Planned Start: October, 1996
   Started: December 1996
   Completion: February, 1997
   Primary Responsibility: Joe Tracy, David Witten
   Comments: Develop outline our activities to date in an effort to develop Phase II.

Phase I Implementation Objective 2.4 - Order and install infrastructure at pilot sites in Cooper County.
   Planned Start: January, 1997
   Started: March, 1997
Completion: May, 1997
   Primary Responsibility: Joe Tracy, David Witten, Sue Becklenberg
   Comments: Complete

Phase I Implementation Objective 2.5 - Complete infrastructure component of Site Development Plans for Phase II sites.
Planned Start: December, 1996
Started: June, 1997
Completion: August, 1997
   Primary Responsibility: Joe Tracy, David Witten

Objective 3 - Deliver Integrated and Secure Telemedicine Services
Deliver a well-integrated and secure set of telemedicine services through the project’s infrastructure and the NII, including an integrated World Wide Web based interface to major telemedicine resources, health care database access, clinical information systems, email, and other forms of telemedicine, based in part on the assessment of the specific needs of health care providers in participating communities.

Phase I Implementation Objective 3.1 - Develop and implement electronic security measures for remote access to MU-HSC clinical information systems.
Planned Start: October, 1996
Started: October, 1996
Target Completion: September, 1999
Completion:
   Primary Responsibility: Bill Saracini
   Comments: Security/confidentiality committee for the Health Sciences Center is dealing with all electronic security issues. NRC report is being used as basis for writing security plan. With an ever changing climate in regard to electronic security the compilation of a final plan for dealing with subject will simply not be possible within the timeframe of this project. The committee dealing with this issue continues to monitor and adjust to all State and Federal regulations in this area.

Phase I Implementation Objective 3.2 - Complete a Telemedicine Information Services Plan, based on needs assessment results, specifying how the project will develop and deliver additional telemedicine information services.
Planned Start: March, 1997
Started: June, 1997
Completion: August, 1997
   Primary Responsibility: Bob Hodge, Barry Kling, Joe Tracy and Teri Hartman
   Comments: Detailed plan based on Phase I experience to be completed in August.

Phase I Implementation Objective 3.3 - Implement the World Wide Web based project interface on the project’s server and make it available to users.
Planned Start: December, 1996
Started: April, 1997
Completion: May, 1997
Primary Responsibility: David Witten
Comments: Complete.

Phase I Implementation Objective 3.4 - Select email product, purchase copies for project
staff and pilot sites, and bring it on line.
Planned Start: October, 1996
Started: January, 1997
Completion: April, 1997
Primary Responsibility: David Witten and Joe Tracy
Comments: Complete

NOTE: 3.5 AND 3.6 WERE OMITTED FROM THE PLAN UNDER THE BEST & FINAL
OFFER. THEY ARE PROVIDED HERE FOR INFORMATIONAL PURPOSES.

Phase I Implementation Objective 3.5 - Develop and field test pilot Web-based
continuing education activities for health professionals.
Phase I Implementation Objective 3.6 - Develop project Continuing Education plan
based on needs assessment results.

Phase I Implementation Objective 3.7 - Develop detailed plan for the project’s literature
searching and document delivery services.
Planned Start: October, 1996
Started: August, 1997
Target Completion: Original Target: January, 1997 Revised Target: January 1998
Completion:
Primary Responsibility: Bob Hodge and Teri Hartman
Comments: Documents can be searched and ordered online through the MUHSC
Library. Delivery instructions are also provided upon ordering.

Phase I Implementation Objective 3.8 - Develop and pilot test Web pages providing
access to selected information resources designed for rural providers.
Planned Start: October, 1996
Started: March, 1996 (actual programming)
Target Completion: January, 1997
Completion: September, 1997
Primary Responsibility: Bob Hodge & Teri Hartman
Comments: Recommended healthcare WWW sites are available and kept current each
week by the Sr. Health Program Specialists.

Phase I Implementation Objective 3.9 - Implement STAR for the project’s pilot sites in
Cooper County
Planned Start: October, 1996
Started:
Target Completion: April, 1998
Completion: June, 1998
Primary Responsibility: Mike Barnes
Comments: Security and access issues are currently being addressed before making this product available in the rural communities. STAR is currently available to the Health Sciences Center physicians. The current version of STAR is the only totally Java based client server clinical document retrieval system in active use. This objective is slated for release in April 1998 to University physicians in the project sites.

Phase I Implementation Objective 3.10 - Develop a detailed Project Security Plan.
Planned Start: October, 1996
Started: October, 1996
Target Completion: September 1999.
Completion:
Primary Responsibility: Bill Saracini
Comments: Security/confidentiality committee has been formed. NRC report is being used as basis for writing security plan. Unique access control mechanism being developed based on the patient limiting access. With an ever changing climate in regard to electronic security the compilation of a final plan for dealing with subject will simply not be possible within the timeframe of this project. The committee dealing with this issue continues to monitor and adjust to all State and Federal regulations in this area.

Objective 4 - Support Users in Adopting Telemedicine

Provide the training, management strategies and technical support needed to enable rural health care providers to adopt and effectively utilize telemedicine services available through the NII and the infrastructure provided by the project.

Phase I Implementation Objective 4.1 - Develop detailed Project Training Plan based on needs assessment findings.
Planned Start: March, 1997
Started: March, 1997
Target Completion: August, 1997
Completion: August, 1997
Primary Responsibility: Teri Hartman & Bob Hodge

Phase I Implementation Objective 4.2 - Develop and pilot test Web-based just-in-time training modules and other training activities.
Planned Start: October, 1996
Started: June, 1997
Completion: Completed
Primary Responsibility: Bob Hodge and Teri Hartman
Comments: This feature is provided under the RTEP Workstation “Help” button.

Phase I Implementation Objective 4.3 - Convene advisory group in pilot community (Cooper Cty) and establish regular meetings in the community and Columbia.
Planned Start: October, 1996
Started: November, 1997
Target Completion: On-going
Primary Responsibility: Joe Tracy and Linda Cooperstock
Comments: Have had three meetings (December, April, June).

Phase I Implementation Objective 4.4 - Form advisory groups in each community, and Project Advisory Group, and establish a plan for regular meetings in the communities and in Columbia for Phase II.
Planned Start: March, 1997
Started: March, 1997
Completion: On-going
Primary Responsibility: Joe Tracy
Comments: Groups formed in all communities. The meetings are staffed by the Sr. Health Program Specialists employed under the NLM Contract but community members provide the leadership.

Phase I Implementation Objective 4.5 - Develop a specific plan for the cultivation of opinion leaders in the pilot community and in Phase II sites, and for the development of user groups in larger facilities to work on integrating telemedicine into daily work life.
Planned Start: October, 1996
Completion: On-going
Primary Responsibility: Joe Tracy
Comments: This is achieved through advisory group meetings specified in Objective 4.4.

PHASE II

Phase II Administrative Objectives

Phase II Administrative Objective 1 - Hire additional staff for Phase II (User Support/Training Staff to be stationed in additional communities).
Planned Start: October, 1997
Started: August, 1997
Target Completion: September, 1997
Completion: March, 1998
Primary Responsibility: Joe Tracy
Comments: Recruitment started in 8/97. Two Network Support Specialists were hire in November 1997 for the Brookfield and Macon areas. One Sr. Health Program Specialist was hired for the Boonville area (Teri Hartman moving to the Macon area). The Sr. Health Program Specialist position for Brookfield was hired in March.

Phase II Administrative Objective 2 - Submit Quarterly Reports to NLM
Planned Start: first quarter
Completion: Per contract
Primary Responsibility: Joe Tracy

Phase II Administrative Objective 3 - Convene meetings of key project staff approximately weekly.
Planned Start: October, 1997
Completion: On-going  
Primary Responsibility: Joe Tracy  
Comments:

Phase II Administrative Objective 4 - Convene meetings of key technical and information resources staff approximately weekly.  
Planned Start: October, 1997  
Completion: On-going  
Primary Responsibility: Joe Tracy, Bob Hodge & David Witten  
Comments: Senior Health Program Specialists are completing activity reports on a monthly basis. Meetings with the information specialists, Director and Medical Director are being held at biweekly via video conference to keep expenses at a reasonable level.

Phase II Administrative Objective 4.1 [NEW] - Plan for sustainability of the project.  
Planned Start: October 1997  
Started:  
Target Completion: March, 1999  
Completion  
Primary Responsibility: Weldon Webb, Joyce Mitchell and Joe Tracy  
Comments: The Macon and Brookfield Community Advisory Groups submitted an NLM Information Access proposal which if funded would start in October 1999. The MUHSC staff continues to explore communication options that would reduce the need for dedicated T1 lines while maintaining an adequate level of network service. The Boonville Advisory group is also considering an alliance with a local non-profit to sustain the project. The Boonville Advisory group has talked with the mid-Missouri AHEC about exploring grant possibilities that would seek additional outside funding. In November 1999 the project director developed a checklist of items (i.e., notice to sites of contract termination, notice regarding equipment disposition, etc) for closing out the contract on January 31, 2000.

Phase II Administrative Objective 5 [NEW] - Continue the Boonville-Brookfield-Macon Telemedicine News Project Update  
Planned Start: October 1997  
Started:  
Completion: On-going  
Primary Responsibility: Joe Tracy and Teri Hartman  
Comment: The Announcements Page on the RTEP Workstation is now providing the most up-to-date information regarding the project. As such it is no longer necessary to publish a written document to distribute to the users in the project communities.

Phase II - Implementation Objectives

Objective 1 - Evaluate Rural Telemedicine  
Study the costs, benefits and other effects on rural health care of integrated telemedicine systems based on the National Information Infrastructure (NII).
Phase II Implementation Objective 1.1 - Periodically conduct on-going needs assessment activities.
Planned Start: October, 1997
Started: On-going
Completion: On-going
Primary Responsibility: Barry Kling, Bob Hodge, and Teri Hartman
Comments: On-going needs assessment activities will be conducted by the project's user support staff. The Boonville community RTEP participants are queried during and after training sessions as to what their current and future perceived needs are in the areas of information, software, and training requirements. When the other communities are networked, the same procedures will be conducted.

Phase II Implementation Objective 1.2 - Implement automated activity reporting measures and review data for evaluation purposes at least quarterly.
Planned Start: October, 1997
Started: On-going
Completion: On-going
Primary Responsibility: David Witten, Barry Kling
Comments: Email logs continue to be captured and archived. These are being forwarded to members of the evaluation team daily. Webserver and Proxy logs continue to be captured and archived. These are being forwarded to members of the evaluation team weekly.

Phase II Implementation Objective 1.3 - Implement evaluation plans developed during Phase I.
Planned Start: October, 1997
Started: On-going
Completion: On-going
Primary Responsibility: Barry Kling
Comments: A detailed evaluation plan for Phase II was submitted as part of the Phase I Final Report and Phase II Plan. A summary of evaluation activities related to the evaluation plan will be provided with each quarterly report.

Phase II Implementation Objective 1.4 - Convene Evaluation Team Meetings approximately monthly.
Planned Start: October, 1997
Started: On-going
Completion: On-going
Primary Responsibility: Barry Kling
Comments: Barry Kling will be in contact with evaluation team members at least 2 or 3 times a month. The team originally agreed that monthly meetings of the group were not necessary, but has since reconsidered. Thus, starting in December 1997, meetings of the evaluation team will be held monthly.
Video systems were eliminated from the project before it began. As such the following objective is no longer applicable.

Phase II Implementation Objective 1.5 - Use activity reporting forms for video-based telemedicine at MTN sites and in nursing homes, and review data quarterly.

Objective 2 - Implement Telemedicine Infrastructure and Connect it to the NII

Implement digital infrastructure, based on commercially available technology, linking all major components of the health care delivery system in three rural communities (Boonville, Macon, and Brookfield), and connecting them to the University of Missouri Health Sciences Center (MU-HSC) and to the NII. Provide the central computing and telecommunications resources, such as a project Web server, necessary to provide telemedicine services via the local infrastructure.

Phase II Implementation Objective 2.1 - Operate and support the project Web server and other computer systems needed for project staff.
Planned Start: October 1997
Started:
Completion: On-going
Primary Responsibility: Joe Tracy and David Witten
Comments: Daily operation and management of server resources by Clark Hall staff continues. The development and production server operates at that location. Systems are backed up to tape locally and 24 hour per day monitoring is provided through a pager alert system. This environment will provide for the further refinement of RTEP without interfering with continued operations. Three new web servers were purchased in the last year of Phase II to create a more longer term sustainability solution for RTEP, associated list serves, e-mail users, etc., for users connecting through the MUHSC network. These web servers were installed and began operating in late November 1999.

Phase II Implementation Objective 2.2 - Deploy infrastructure in the two remaining Phase II communities and at any remaining sites in Boonville as specified in the Site Development Plans developed in Phase I.
Planned Start: October, 1997
Started:
Target Completion: March, 1998
Completion: March, 1998
Primary Responsibility: Joe Tracy and David Witten
Comments:

Phase II Implementation Objective 2.3 [NEW for Phase II] - Set up individual server email and web site accounts.
Planned Start: September, 1997
Started: September, 1997
Completion: On-going
Primary Responsibility: David Witten, Teri Hartman
Comments: E-mail accounts are now being setup as end users complete the enrollment kits for the project.

Objective 3 - Deliver Integrated and Secure Telemedicine Services
Deliver a well-integrated and secure set of telemedicine services through the project’s infrastructure and the NII, including an integrated World Wide Web based interface to major telemedicine resources, health care database access, clinical information systems, email, video conferencing and other forms of telemedicine, based in part on the assessment of the specific needs of health care providers in participating communities.

Phase II Implementation Objective 3.1 - Continue to implement, and monitor electronic security measures for remote access to MU-HSC clinical information systems.
Planned Start: October, 1997
Started:
Completion: On-going
Primary Responsibility: Bob Hodge & Bill Saracini
Comments: Security/confidentiality committee for the Health Sciences Center is dealing with all electronic security issues. NRC report is being used as basis for writing security plan. We are considering switch to secure socket (https) for RTEP II Workstation. With an ever changing climate in regard to electronic security the compilation of a final plan for dealing with subject will simply not be possible within the timeframe of this project. The committee dealing with this issue continues to monitor and adjust to all State and Federal regulations in this area.

Phase II Implementation Objective 3.2 - Develop additional telemedicine information resources based on the Telemedicine Information Services Plan produced during Phase I, and on the basis of on-going needs assessment.
Planned Start: October, 1997
Started:
Completion: On-going
Primary Responsibility: Bob Hodge and Teri Hartman
Comments: Resources within the RTEP Workstation are being developed and we will get user comments and recommendations as we progress with implementation. The comments and recommendations are generally gathered by the Sr. Health Program Specialists on their regular visits to each RTEP site.

Phase II Implementation Objective 3.3 - Make available to users in Phase II communities the project’s World Wide Web based interface and associated telemedicine services.
Planned Start: October, 1997
Started:
Target Completion: On-going
Completion:
  Primary Responsibility: David Witten, Bob Hodge and Teri Hartman
  Comments: The RTEP Workstation was deployed in February, 1998. There are now over 1100 accounts. The RTEP II Workstation platform went live in December 1999.

NOTE: OBJECTIVE 3.4 WAS OMITTED FROM THE PLAN UNDER THE BEST AND FINAL OFFER. IT IS PROVIDED HERE FOR INFORMATIONAL PURPOSES.

Phase II Implementation Objective 3.4 - Deliver Web-based and video-based continuing education activities for health professionals based on the project’s Continuing Education Plan developed in Phase I.

Phase II Implementation Objective 3.5 - Provide literature searching and document delivery services based on plans developed in Phase I.
  Planned Start: October, 1997
  Started: On-going
  Primary Responsibility: Bob Hodge and Teri Hartman
  Comments: Teri Hartman is working with the MUHSC library and other medical libraries serving this area to establish more direct inter-library loan and document delivery procedures for the RTEP participants. OVID access was implemented for those who qualify under the University License.

Phase II Implementation Objective 3.6 - Provide and maintain Web pages providing access to selected information resources designed for rural providers.
  Planned Start: October, 1997
  Started: On-going
  Primary Responsibility: Bob Hodge, Teri Hartman and David Witten
  Comments: The RTEP Web Site is customizable so that each user can choose his or her own configuration and be allowed access to selected pages. For example, only physicians will have access to STAR. Other resources that were added include OVID, discussion groups with web archive pages and the electronic consult service

Phase II Implementation Objective 3.7 - Implement and support STAR for the project’s Phase II sites.
  Planned Start: October, 1997
  Started: April 1998 and then On-going
  Primary Responsibility: Bob Hodge
  Comments: STAR is ready for deployment to University physicians practicing in the RTEP sites. Deployment began in June 1998. A Policy to provide STAR access to non-University physicians was approved and application/enrollment forms were developed and reviewed by the staff, medical records staff and MU legal counsel. The final forms are being developed and meetings with medical records and the physician network
development staff are being scheduled. The roll-out of STAR to non-MUHSC employed physicians may begin very close to or just after the close of this contract.

Phase II Implementation Objective 3.8 - Implement the Project Plan developed during Phase I and monitor its effectiveness.
Planned Start: October, 1997
Started:
Completion: April 1998 and then On-going
Primary Responsibility: Bob Hodge and Bill Saracini
Comments: The implementation of the Project’s Security Plan for releasing patient data to non-University physicians was approved in the 4th Qtr. 1999. See objective 3.7 above for further information. It is important to note the security plan is a dynamic document and will change as needed or required with the further development of Federal and State policies in this area.

Phase II Implementation Objective 3.9 [NEW] - Set up online discussion groups in all three RTEP communities.
Planned Start: Cooper – October ‘97; Macon – December ‘97; Linn – February ‘98.
Started:
Completion: On-going
Primary Responsibility: Robert Hodge, Teri Hartman
Comments: A general discussion group (RTEP-List) and a physicians list (DOC) was developed. The RTEP-L list has been active with at least one new discussion or news message posted by the information specialist each week.

Phase II Implementation Objective 3.10 [NEW] - Implement Electronic Consult Service.
Planned Start: September 1997
Started: December 1998
Target Completion: March 1998 (Original 1/98) and then On-going
Completion: Ongoing
Primary Responsibility: Robert Hodge
Comments: Service started in December with a number of specialties. Specialties include child health, high risk OB, general surgery, trauma, and geriatrics.

Phase II Implementation Objective 3.11 [NEW] - Implement Electronic Pearls
Planned Start: March 1998 (original date 10/97)
Started:
Completion: On-going
Primary Responsibility: Robert Hodge
Comment: This service is pending the implementation of the electronic consult service.
Update 3rd Qtr: This will not be implemented due to lack of demand/interest and the development/focus of similar information elsewhere.

Objective 4 - Support Users in Adopting Telemedicine
Provide the training, management strategies and technical support needed to enable rural health care providers to adopt and effectively utilize telemedicine services available through the NII and the infrastructure provided by the project.

**Phase II Implementation Objective 4.1 - Implement the Project Training Plan developed during Phase I, and update it on the basis of on-going needs assessment.**

Planned Start: October, 1997  
Started:  
Completion: On-going  
Primary Responsibility: Joe Tracy, Bob Hodge, and Teri Hartman  
Comments: *UPDATE 1st Qtr 1999 - Training is now on an as needed basis.*

**Phase II Implementation Objective 4.2 - Deliver and support Web-based just-in-time training modules and other training activities.**

Planned Start: October, 1997  
Started:  
Completion: On-going  
Primary Responsibility: Bob Hodge and Teri Hartman  
Comments: *Training modules have been developed for all functions of the RTEP Workstation and Exchange email program. All training materials used with RTEP members are now on the RTEP Workstation under Help.*

**Phase II Implementation Objective 4.3 - Convene regular advisory group meetings in the community and in Columbia.**

Planned Start: October, 1997  
Started:  
Completion: On-going  
Primary Responsibility: Joe Tracy, Bob Hodge and Teri Hartman  
Comments: *Community Advisory Groups (CAG) have convened in all three communities and are meeting on a monthly basis. The CAGs are staffed by the SHPSs and have assigned Facilitators, Record Keepers, and Time Keepers. Identifying sources of funding for sustaining the community networks continues to be discussed.*

**Phase II Implementation Objective 4.4 - Make regular contact with opinion leaders among health professionals at Phase II sites, and develop user groups in larger facilities to work on the integration of telemedicine into daily work life.**

Planned Start: October, 1997  
Started:  
Target Completion: On-going  
Completion:  
Primary Responsibility: Joe Tracy  
Comments: *Mr. Tracy contacts health facility administrators and physicians on a regular basis to discuss telemedicine issues.*
Utilization Findings

In this section we provide additional charts and tables describing RTEP utilization. Comments accompany some of the charts.

Linn, Macon and Cooper Counties were RTEP’s rural sites, and Boone County is the site of MUHSC.

Web Hits

RTEP’s proxy server was used to log all page requests made by an RTEP user from within the RTEP Workstation. The record generated for each request also indicated the time and date, the login name of the user logged on at the time of the request, and the number of bytes transferred. When a user hits a web site, of course, many incidental requests are generated for the various images and other features of the page. To produce as good an indicator as possible, and to keep the volume of data manageable, we included in our databases only requests whose URLs contained any of the following strings:

.HTM OR .HTML
.SHTM OR .SHTML
This excluded many extraneous hits that would have greatly inflated the already considerable quantity of data without adding to its value, while retaining a broad enough selection of requests to produce a reasonable indication of a user’s activity. In the following charts, hits are defined as page requests meeting these criteria. It should also be mentioned that some RTEP users who began with or developed a high level of comfort with the Web certainly used it at times without going through the RTEP portal, especially from home.
Monthly RTEP NLM Hits by Work Type

- Medicine
- Nursing
- All Others

Monthly NLM and Other Library Hits

- NLM Hits
- Other Library Hits
MTN Utilization

Although the Missouri Telemedicine Network was not funded originally by NLM, RTEP enabled us to continue operating a data system that tracked MTN activities and collected data from the providers and patients involved. The following charts summarize MTN clinical encounters, meetings and educational programming.

In many lectures and articles on telemedicine, rural doctors have been portrayed sitting next to their patients as both absorb the healing wisdom of a distant specialist seen on the video screen. We doubted this scenario from the beginning. The rural providers we knew did not have time to spend an hour participating in a consult that would normally occur in their absence. It seemed to us that the direct care of rural patients by HSC physicians was a much more useful application of telemedicine. As the following chart indicates, that has been the case in MTN. A rural physician was present with the patient during in only about 10% of clinical encounters. The second chart on the next page shows the growing predominance of direct care over specialty consultation in MTN clinic visits. These data also illustrate that the fears of some rural primary care providers that telemedicine would help the HSC steal their patients are unfounded. MTN’s main effect is to allow patients to stay in their own communities to receive specialty care for which they would have otherwise had to travel. This local availability of specialty care, if anything, improves the viability of a rural primary care practice.
Consult: An encounter is a consult when it is done at the request of a referring physician (or other primary care provider) who expects the consultant to report back to the referring physician about the specialist's findings, so that the primary care provider can continue to take care of the patient. Even if the patient, as a result of the encounter, becomes one of the consultant's patients, the first visit is a consult if it meets this criterion. A physician to physician discussion would be a consult.
MTN Clinical Encounters by Specialty

MTN Clinical Encounters by Patient County

Numbers from 11/1/95 to 10/31/99
A concern often expressed by providers new to video telemedicine is that the encounters will take significantly longer than in-person visits. Although this is likely to be true for providers who are not yet used to video telemedicine, we found that the average length of visits declines as providers got used to the medium. The next 2 charts address this issue.
MTN Travel Savings

Since 1995 MTN has collected data on travel savings for 1710 patient encounters. The patients involved in these visits were at 18 different rural sites located 25 to 175 miles from the provider, who was at MUHSC in Columbia, Missouri. Of course travel for an in-person encounter would have involved a round trip, doubling these mileage figures.

Given the distance from each site to MUHSC, it was possible to determine that MTN was used to “teletransport” patients a total of over 440,000 miles for these encounters. The average number of tele-transported miles per clinical encounter was just over 261 miles. Of course not all of these miles represent savings, since patients had to travel some distance from their homes to an MTN rural site. The average miles traveled to the MTN site reported by patients was 7.45 miles one way per encounter, producing an average savings of just over 246 miles. Using the current federal mileage reimbursement rate of $0.32 per mile, this amounts to a total savings of $134,527 or an average of $78.76 per encounter in automobile mileage.

Time as well as mileage was saved by these MTN encounters. There are various ways to estimate the economic value of this time. MTN asked patients about their employment status and annual income, but the response rate on these items was very low and they do not provide an adequate basis for estimation. As an alternative, a conservative approach would be to consider the value of work time lost at a low wage such as $5 an hour. Of course not all of these patients were employed, but those who were certainly received an average wage much higher than this figure, which approximated minimum wage during the period involved. In addition, children and some elderly patients were taken to encounters by an adult who may have been employed.
Finally, there is now broad recognition that work performed outside of formal employment – for example, by a mother who maintains a household – has a significant economic value. We believe this approach is conservative in that it errs on the side of underestimating the value of time saved.

One further assumption is needed to generate an estimate from these data, and that is the amount of time represented by the distances involved. Again, we have chosen a conservative approach by assuming that every mile saved represents an average of one minute of time savings. To put it another way, we assumed that the travel was accomplished at an average speed of 60 miles per hour. Those with experience on Missouri’s rural highways will recognize the optimism of this estimate.

On this basis, patients saved an average of about four hours per encounter, or about $20 at $5 an hour. The total value of time saved at this rate was $35,033.

Adding mileage and time savings produces an estimate of total patient travel savings of $169,560, or an average of $99.27 per encounter. Note that these figures include no meals, lodging or other expenses that often result from travel.

When MTN and RTEP were established, equipment for a single video telemedicine site cost $60,000 to $80,000, and the cost of a T1 line to a rural Missouri site was $10,000 to $50,000 a year, depending on the details of local phone service. At these rates, a total savings to patients of about $170,000 may not be very significant (though of course this is not the only benefit of the network). But today it is possible to establish a telemedicine site for $10,000 to $15,000 using equipment far superior to that available when the project began. Dial-up ISDN lines make it possible to conduct a visit for $15 or less in line charges. At these rates, patient travel savings alone represent a significant return on the cost of a telemedicine network.

**Alternatives to Telemedicine**

MTN asked patients what they would have done if telemedicine had not been available. Patients responded in 774 cases, with these results:

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Would not have gotten health care at this point</td>
<td>170</td>
<td>21.96%</td>
</tr>
<tr>
<td>Would have gotten health care in my own community</td>
<td>107</td>
<td>13.82%</td>
</tr>
<tr>
<td>Would have gone out of town for health care.</td>
<td>484</td>
<td>62.53%</td>
</tr>
<tr>
<td>Other</td>
<td>13</td>
<td>1.68%</td>
</tr>
<tr>
<td><strong>TOTALS</strong></td>
<td>774</td>
<td>100%</td>
</tr>
</tbody>
</table>

These figures suggest that 76% of the care delivered by MTN would have occurred anyway in the absence of telemedicine, and that 22% of MTN encounters would not have taken place. These findings address the concern of parties such as HCFA that telemedicine would result in major new utilization. Although a 22% increase in specialty care visits is not trivial, it is far below the HCFA assumption (during the recent federal budget process) that every telemedicine
visit is an excess visit. This level of increase is also quite modest for rural areas currently short of specialty care; it does not in itself suggest unnecessary utilization due to telemedicine.

The following charts on patient and provider satisfaction indicate very high levels of approval. The few negative responses were followed up to determine whether they involved preventable problems.
MTN Educational Programs by Originating Site for RTEP Period
Numbers from 10/1/96 to 10/31/99
Unknown: 18

MTN Educational Programs by Type
Numbers from 11/1/95 to 10/31/99
Teleradiology

Many MTN sites, including some in RTEP communities, were equipped with teleradiology systems meeting ACR standards. These were normally used for emergency and off-hours coverage, since few MTN communities had full time coverage by radiologists. In a few instances MUHSC provided the bulk of local radiology services for a few weeks or months, during the interim between other local arrangements. The next 2 charts summarize our teleradiology utilization.

**MTN Teleradiology Cases -- January 1996 - September 1999**
(Average 3 Films Per Case)

**Missouri Telemedicine Network**
Teleradiology Cases - 9/95 - 10/99

- CCH 39%
- Milan 23%
- Boonville* 6%
- Macon* 13%
- Brookfield* 5%
- Keytesville 1%
- Herman 0%
- Moberly 4%
- Fayette 7%
- Memphis 2%

Total Number of Cases - 13,074 (avg 3 films per case)
* RTEP Community
Email Utilization

RS1P Emai l  Messages Recei ved by Month and County
(No RTEP Litserve)

Messages Sent by Month and County
(No RTEP Listserve)
Numbers in the chart above showing messages received are inflated by the fact that several RTEP account holders were members in professional listserves. These charts exclude the RTEP Listserve, of which all account holders were members, but the others were much larger. Two nurse-anesthetists, in fact, each received over 25,000 messages from their professional list serve during the course of the project. We view messages sent as a better indicator of email use by an individual, since a message sent indicates an action rather than the passive receipt of mail.
Although the project staff regularly encouraged RTEP users to stay within the RTEP Workstation and use the RTEP email client, some activity of course occurred outside that framework. Even at the beginning we were aware that some participants already had email accounts. Most of these were accounts accessed one way or another through a web site. We were able to track this to some extent because often, even when an RTEP account holder used another email account, he or she remained within the Workstation to do so. Although this activity did not show up in our email logs, we did capture the web hits.

About 40% of these hits involved one of the common sources of web email:

http://mail.yahoo.com/
http://www.hotmail.com/
http://mail.excite.com/
http://hotmail.com/
http://webmail.netscape.com/

Unfortunately these Web email numbers cannot be directly compared to data from RTEP’s email logs. Each record in the email logs documents a single message from one user to another. It is not possible, however, to know how one or a hundred web page requests translates into messages sent or received. There must be multiple page requests for every message, since most email web sites involve multiple screens with multiple elements. Not all of these are screened from the raw web logs. Furthermore, anyone with an outside email account is likely to have the digital wherewithal to use it with a browser without needing to go through the RTEP Workstation. It is likely that a considerable amount of email activity was missed in this way, too.
The point of these numbers, however, is to indicate the general pace of adoption of these
telemedicine resources, and to provide a good basis for comparison between different groups of
users. The more experienced users – who are the ones most likely to use outside email – are if
anything slightly underrepresented in our numbers.

Incomplete Studies

**Loch Haven Nursing Home Study** – Macon’s Loch Haven Nursing Home, a 200 bed long term
care facility participating actively in RTEP, is the site of a study on the question of whether
email could improve communications between a nursing home and its patients’ physicians. The
study was developed based on the input of physicians and nurses experienced in rural long term
care. They identified communications of this kind as a chronic difficulty in rural nursing homes
and suggested that email, if sufficiently ubiquitous in the local health care system, could be used
effectively to address the problem. The main hypothesis is that the use of email for
communication of this sort would reduce the average time elapsed between the observation of a
patient condition requiring physician input, and the resulting response from the physician.

Baseline data were collected from patient charts on instances of this kind for the two year period
beginning on July 1, 1997. All patients were included. To qualify for inclusion in the study an
incident had to involve a charted observation of a patient condition requiring the input of a
physician or nurse practitioner, with the time and date of the observation clearly indicated and
with a clear entry on the resulting order. Although charting is imperfect, this facility makes an
ongoing effort to assure that nurses chart these observations as accurately as possible, and nurses
have a personal interest in documenting observations important enough to require a medical
response. In addition, charting inaccuracies are likely to be distributed randomly among
instances that do and do not involve email in some way. The period covered by the baseline data
overlapped with the introduction of RTEP email, but the use of email for communications of this
kind did not occur to any significant degree during the baseline period.

The following data elements are collected on each instance:

- Entry Number – Unique identifier for this record.
- Date data was collected from chart
- Unit Number – Which nursing unit in Loch Haven
- Collected By – RTEP staff member who collected data
- Patient Number – the facility’s patient identifier
- Gender
- Age
- Provider # -- An identifier assigned by the study
- Time/Date of observation
- Full text of chart entry on the observation
- Time/Date of first attempt to contact provider
- How contact was attempted (phone, fax, email, etc)
There were 919 instances on which we could collect complete data.

As RTEP came to an end email was beginning to become a routine tool for communications between the Loch Haven nursing staff and some physicians. The next step in the study will be to collect chart data as email utilization becomes more routine, in order to compare those data to the baseline observations. MUHSC is attempting to secure funding for completion of the study.

**CIT Study** – A study of physician information searches was planned using the Critical Incidents Technique. Data collection would have involved periodic reports by physicians on the most recent search they conducted and on the extent to which telemedicine resources were involved. Two factors lead us to cancel the study. The first was a pilot study showing that physicians would not respond consistently enough to produce usable data. This was one of our concerns from the beginning, and was further highlighted by discussions during the NLM site visit in June of 1996. In response we conducted a pilot study with 20 volunteer physicians. Unfortunately the response was very poor, even after repeated contacts. For example, only six of them provided even the minimal information needed for study enrollment in spite of earlier statements that they were willing to participate. The second discouraging factor had to do with the one reward we had planned to offer participating providers – CME credit for their search activities. Changes in ACCME rules and interpretations made this impossible, further reducing the likelihood of adequate data collection. The study was therefore cancelled.

**Physician survey** – Early in the project we conducted a mail survey of primary care physicians to provide a basis of comparison of RTEP physicians to others in Missouri, and to lay groundwork for subsequent studies of physician job satisfaction. The response rate was under 35% in spite of repeated follow up mailings and calls, and a decision was made not to continue the study.
Appendices: RTEP Articles
A Distributed Telemedicine Application Based on Directory Services
David M. Witten II, Mihail Popescu, Robert Hodge, M.D.

Abstract

Objective: The authors describe the development of a flexible, manageable vehicle for distribution of information to medical professionals located at a large number of rural locations. System requirements include location independence, the ability to store properties and preferences for each individual user, the ability to grant selective access to individuals and groups of users based on a wide variety of criteria, and robust security.

Design: This project is based on the design of a project begun two years earlier under contract to the National Library of Medicine. Our goal was to create an improved version of the original application built around an industry standards-based directory services core. This approach was intended to pave the way for integration of this and future institutional Intranet applications with existing authentication resources. We hoped to build on a foundation that could provide scalable interoperability with a comprehensive enterprise security infrastructure.

Methods: Our objective was to move the previous application away from its use of a relational database to a more generic Local Directory Services Access Protocol (LDAP) based directory services foundation. Building on this, we wanted to address a various problems that bedevil modern medical information environments. Prominent among these was the familiar proliferation of user authentication tokens required by modern medical information systems, as well as the ballooning management burden they incur. To this end we attempted to implement a toolset that could support a global vision of the extended information environment in which medical providers function, while leveraging existing institutional resources. While we used a commercially available Intranet development environment, the essential features are readily duplicated with Open Source software products.

Results: We found that while the principles underlying the technology we implemented were straightforward, making them work presented substantial challenges on both technical and political fronts. In particular, the objective of implementing seamless integration with the existing electronic mail system proved difficult and remains only partially realized. Even more difficult was the task of communicating the implications, scope, and potential benefits of such an approach to the institutional stakeholders throughout the test network whose cooperation (and enthusiasm) was essential to making a meaningful impact on patient care.
Article

Background:

At the time this project was begun, the Missouri Telemedicine Network (MTN) included approximately 18 sites connected by a mix of point-to-point T1 lines and Frame Relay services. This network was designed to make it possible for health professionals to care for rural patients using interactive video systems, electronic medical instruments, and Internet communication tools. In October of 1996 the University of Missouri, Columbia received funding through the National Library of Medicine to create the Rural Telemedicine Evaluation Project (RTEP). The purpose of this project was to evaluate the impact of expanded access to a variety of information resources on health care in three sites served by this network.

At the inception of the Rural Telemedicine Evaluation Project (RTEP) we proposed providing participants in the project with a configurable desktop application that collected a number of Internet-based resources of interest to health care providers. While this was not unique undertaking at the time, we were well positioned to expand on an established rural telemedicine network that had successfully avoided many of the barriers to provider acceptance that had been encountered by other institutions. We anticipated that the list of features and services we would provide would grow as we gained experience. We were planning, though the term was not used at the time, a wide-area Intranet for a large pool of health care providers throughout Central Missouri.

Predictably, we faced many programming and system management challenges in the course of this development. One resource that we were especially interested in being able to provide was reliable, secure email. Though email is technologically a relatively simple service, its ability to map communications to actual patterns of work within an organization must not be underestimated.

Contrary to most expectations, asynchronous, store and forward forms of delivery for patient care information have repeatedly been proved to be an essential compliment to real-time and interactive modalities for in health care. At the outset we did not have the ability to provide a completely suitable mail interaction through a Web interface. Instead we provided accounts on a mail server that offered direct access through the Post Office Protocol v. 3 (POP3) protocol. Users had to load a separate email client and authenticate using a user id and password maintained on that server. This was a problem we were fortunately able to address early on.

During the course of the project the University of Missouri implemented Microsoft Exchange for almost all messaging system wide. The project team was able to modify the interface provided by the Microsoft Outlook Web Client for Exchange to integrate it completely into the RTEP application. We were able to make significant improvements to the default interface and provided expanded features such as personal mailing lists. In addition, by integrating mail into the desktop we were able to eliminate the need for a separate logon. The development team was successful in passing authentication credentials to the Exchange server without further intervention by the user, integrating a particularly difficult piece of technology into the larger enterprise context.
Design:

The redesign of this project set priorities on the following capabilities:

- Provide users with the ability to access RTEP resources from any Internet connection using standard Web browsers.

- Enable users to send and receive messages anywhere on the Internet. It was anticipated that the use of email could eliminate a lot of the "telephone tag" that occurs in communicating with other clinicians, health care facilities, or staff.

- Provide access to STAR - a Java-based interface to text components of the electronic medical record for patients seen at UMHSC which has been developed locally.

- Support Internet searching for medical information. A feature called the Search Depot has links to many popular search engines as well as the National of Library of Medicine databases such as Medline.

- Provide the ability to read and/or print full text clinical articles from the OVID system used by the UM Health Sciences Library.

- Allow a user to request article reprints from the UM Health Sciences Library

- Allow a user to save favorite web sites for use from any location.

- Provide staff the option of participating in discussion groups with other users on subjects of mutual interest.

- Keep up to date on community happenings through links with local web sites including weather and business information.

Methods:

A major requirement for the evaluation component of the RTEP project was the ability to log various kinds of information that could help determine patterns of use and provider interaction. Initially, the Web server’s log files, plus logs of email activity provided by the POP3 server, were the only tools available to track this utilization. The POP3 server gave good information about the source and destination of email traffic. The Web server’s logs provided information about patterns of access to the pages of the RTEP application itself, as well as to any other pages stored on that particular server. Neither of these tools provided any useful information concerning the user’s interactions with Internet resources outside the direct control of the project.

The RTEP team quickly realized that more detailed information about the project participant’s use of the Internet could be captured by using a proxy Web server. This is not strictly the normal use for which a proxy server is designed, but the logging capabilities such servers provide worked well for the needs of this project. When this server was installed all Web browser activity was directed through it. This allowed us to
track all page requests by project participants, rather than just the ones for pages residing on servers managed by the project.

![User Hierarchy Diagram]

**Figure 1. Typical RTEP user schema resembles a directory tree**

We identified four types of users for the RTEP workstation:

1) Regular users. These included Nurses, physicians, and other medical professionals.
2) Administrative users in charge of maintaining the overall system.
3) Content providers and Information Specialists who maintain the information provided for each user category.
4) Guest users who can access limited for demonstration purposes

The schematic of the user hierarchy is presented in figure 1. The user structure lends itself to implementation using an object directory services provider.

![Organizational Model Diagram]

**Figure 2. The RTEP v 1.0 organizational model.**
There is a content provider for every leaf node in the regular user subtree. The structure of the user hierarchy allows for additional groups to be added in the future. As the basis for the project, the user tree structure needed to be carefully defined.

It was impossible to determine the exact mix of centrally provided and locally provided services in at the time we began this project. The original project plan called for certain services to be provided from hub servers at the rural sites themselves. Some of the machines located in the rural communities were initially configured to allow such use. These machines were set up with Windows NT 4.0 rather than Windows 95, as were the workstations, and had somewhat larger memory and storage configurations.

As work progressed it became apparent that more of the services could be provided optimally from a central location. Many factors contributed to this, but most important were the extremely rapid developments in Internet technologies and the expansion of the range of resources that could be offered in that format. Using Web tools wherever possible allowed both more detailed and more reliable capture of usage statistics. This also facilitated the construction of a centrally maintainable application for use across a

**Figure 3. The RTEP II organizational model showing interaction with other Intranet applications.**
widely distributed dedicated network in a manner that still allowed customization by end users. Under this altered design the machines with expanded configurations have served instead as management platforms for the network support and information specialists located in the communities.

The use of standards-based Lightweight Directory Services Access Protocol (LDAP) allowed substantial flexibility to meet future needs. The LDAP specifications describe a directory access protocol and a portable programming interface that provide both read and update access. This protocol is a limited derivative of the protocol for directory access defined by the ISO OSI Directory Standard (CCITT Recommendation X.500). These standards were designed to provide access to information concerning objects in the network. The LDAP service is optimized for ‘read-mostly’ access to information concerning the characteristics of users and the network resources they access. It is essentially an object-oriented database designed to map well to the organizational structure of large institutions.

Enterprise directory services are effective repositories for various kinds of information critical to the operation of large institutions. They are being used store identifying personal data, user’s public keys for digital signatures and encryption, and information about a user’s rights to access information or reserve bandwidth in the network. Coupled with trusted third party authentication providers such as Kerberos they are essential to any implementation a large-scale public key infrastructure. The non-repudiation provided by digital signatures using public key cryptography is a critical for enabling future information flow management in medicine.

The implementation of LDAP utilized in this project is that contained in Microsoft’s Site Server v. 3.0 Intranet development package. While this product provides a reasonably standard implementation of the basic directory services, it also provides the ability to map control of user resources onto an existing Microsoft networking domain. It does this by using Microsoft’s proprietary Active Directory Services Interface (ADSI), which is also able to interact with other directory services providers such as Novell’s NetWare Directory Services (NDS). Similar cross platform capability is under development by a number of providers, including Novell.

By shifting our focus to make the directory service the centerpiece of the application design, we hoped to achieve significant enhancements in scalability and manageability for our nomadic computing environment. By taking a consistent approach we were able to provide an environment that can realistically support features such as digital signatures and extended virtual private networks. By using tools that allow us to map user authentication for users of our intranet application onto existing authentication resources we are able to minimize both the number of times a user is required to login to the network and the number of passwords that have to be maintained.

**Conclusion:**

In this project we found that while the principles underlying the technology we were attempting to implement were straightforward, delivering that technology in a form that truly enhanced patient care offered significant challenges on both technical and political fronts. In particular, the objective of implementing seamless integration with the existing electronic mail system proved difficult and remains only partially realized.
There are a number of additional areas that we would have liked to explore in this version, but were unable to pursue at this time. Implementation of LDAP directory services in the network switching equipment would allow implementation of policy-based Quality Of Service (QOS) management of network bandwidth, allowing services requiring deterministic packet delivery (audio and video) to be provided over IP, eliminating network duplication and the need for economically impractical point-to-point services. A single packet stream can now carry audio, video, and data. Using these enhancements we could implement improved tools for gathering utilization metrics as well, and begin to work toward integrated management of all intra and extra institutional communication vehicles.

We would also have liked to examine the specific issues involved in implementation of standards-based, secure Virtual Private Networks (VPN’s). These services are essential for providing secure communications in a truly nomadic computing environment. Enhancement of this test bed as it exists would lay the groundwork for evaluating and intelligently implementing standards such as Desktop Management Task Force’s (DMTF’s) Directory Enabled Networks (DEN) standards, which are under ongoing development.

It would have been interesting to explore the use of non-proprietary authentication services such as RADIUS®, Kerboros and the GSS-API®. Examination of a truly vendor neutral set of tools would contribute greatly to our ability to manage patient information in a secure fashion while still maintaining flexibility and a focus on end-user convenience.

A final area that the team would have liked to explore further was the applicability of products such as Polycom, Inc.’s H.323-based interactive videoconferencing hardware, combined with switch-based resource reservation capabilities, to rural medical communications. The TCP/IP-based video conferencing technologies rapidly becoming available may offer the potential to radically alter the economics of rural telemedicine. In the future it will become necessary to purchase of new switching hardware to replacing aging router infrastructure. It would be ideal to explore upgrades to portions of our existing network that could support these new technologies and to pursue the conversion of this network to telecommunications technologies that will be economically sustainable into the future.
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EVALUATING TELEMEDICINE:  
TELEMEDICINE AS A SUBSTITUTE FOR A  
CARDIOLOGY OUTREACH CLINIC--  
FINANCIAL IMPLICATIONS

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EVALUATING TELEMEDICINE:
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FINANCIAL IMPLICATIONS

Telemedicine has been spreading rapidly, both in the United States and in Europe.
The benefits of telemedicine have been widely reported to include the following:\(^1\)

- More efficient and equal access to medical specialists, less waiting time.
- Reduced patient travel
- Lower transportation costs
- Fewer and shorter leaves of absence (due to rapid diagnosis and treatment)
- Reduced number of ambulatory services
- Lower specialist travel expenses
- Increased specialist productivity
- Improved knowledge transfer to rural physicians
- Distance consultation included as part of specialist accreditation
- Better access to patient cases necessary to maintain rural hospitals
- Fewer number of referrals to specialists
- Reduced turnover of medical personnel in rural areas due previously to isolation and lack of access to wider professional network.
- Avoidance of unnecessary surgery (telepathology)
- Improved quality of health care services due to better coordination and continuity of treatment, and better information to the patient.

While the above list was developed in reference to the use of telemedicine in Europe, it is also appropriate for the evaluation of its use in the United States. This is a relatively comprehensive list of potential benefits associated with telemedicine. Not all benefits apply equally to all situations, however. The reimbursement mechanism in Norway is sufficiently different from the US, for example, that one of the expected benefits (reduced referrals to specialists) from telemedicine may not be seen as a benefit to US providers. Fewer referrals to specialists may not be preferable under a fee-for-service type of structure, or where hospital-based specialists are still trying to gain inpatients for

the hospital. In a managed care environment, however, even this benefit is appropriate for the United States' markets. If there is capitation, a greater emphasis should be placed on ensuring that the appropriate provider is providing the appropriate health care services.

This paper addresses the issue of the role of telemedicine in a specialty medical clinic; specifically, the substitution of telemedicine for a rural outreach clinic is explored. The primary focus of this study is on the financial impact of having the specialist remain at a hub clinic rather than travel to an outreach clinic. The specialty used for this study is cardiology.

**Literature Review**

Cardiology is the second most common clinical specialty in which telemedicine has been applied.\(^2\) An overview of the rural applications of telemedicine, which surveyed 2,363 nonfederal hospitals in the US located outside Metropolitan Statistical Areas (MSAs), found that over 43 percent of facilities had attempted some form of telecardiology at least once.\(^3\) Studies examining the feasibility of telecardiology compared to traditional methods have found telemedicine to be an effective alternative for correlating the presence or absence of symptoms with pacemaker dysfunction or dysrhythmias,\(^4\) for the diagnosis of congenital heart defects in neonates,\(^5\) for detecting arrhythmias associated

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\(^3\) Hassol A, C Irvin, G Gaumer, D Puskin et al. (1997).


with infrequent symptoms, and to provide accurate emergency consultative echocardiographs 24-hours a day.

Telecardiology—and telemedicine in general—has the ability to increase access to medical services in areas where specialists are not available, either because the area lacks the specialist or the local specialist was not available when needed. The implementation of telemedicine has been proven to increase, by 13 percent, the potential availability of cardiology, by providing services in places that formerly could not offer such specialties, or supplementing the existing array of specialists available in local communities. This percentage could further increase, as telemedicine training is more widely implemented and as telemedicine networks become more extensively developed.

Along with increasing access to services, telecardiology has the potential to reduce costs substantially for cardiology patients, through a variety of methods. In areas where specialists are unavailable, patients save money and time by being able to receive the services locally. A British study found that cardiology patients on the Isle of Wright could save up to 20,000 pounds annually in reduced travel costs and time. In addition to savings from reduced travel distance, telemedicine can, at times, provide a more cost-effective method of service delivery for cardiology patients. An emergency department study found that 72 percent of those slated for hospital admission because of cardiac risk factors and chest pain suggesting myocardial ischemia could be discharged after normal

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8 Hassol A (1997).

readings were obtained via dobutamine stress tele-echocardiography, resulting in substantial savings to the patient.\textsuperscript{10} Canadian research demonstrated a reduction in unnecessary patient transfers, resulting in an estimated savings of (Canadian) $20,000 to $28,000.\textsuperscript{11} Furthermore, the electronic transmission of neonatal echocardiograms was found to decrease length of stay for newborns by six days, resulting in annual savings of nearly $1.3 million.\textsuperscript{12} These, and other, applications of telemedicine in cardiology have been proven effective cost reduction strategies, while further increasing access to higher quality services and extending additional benefits to patients, such as faster delivery of services. These findings suggest the need for further evaluation of cost-reducing strategies for telecardiology.

\textbf{Model}

This report is part of the Rural Telemedicine Evaluation Project/Rural Telemedicine Grant Program (RTEP/RTGP) at the University of Missouri. A comprehensive evaluation model was developed to provide a framework for individual studies associated with this project. The comprehensive evaluation framework is fully described elsewhere,\textsuperscript{13} but its components are shown in Figure 1. The three dimensions involved (explicitly or implicitly) in any telemedicine evaluation project include: level of analysis (society, community, individual), focus of analysis (cost, quality, access), and activities of analysis (clinical,

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educational, administrative). The highlighted block indicates the subject of this specific study—an individual level of analysis of the cost associated with a specific clinical activity. Specifically, this project provides an examination of the financial impact on a cardiology clinic from the use of telemedicine equipment for clinical activities.

The initial step in this examination is to identify the options available for the provision of cardiology services. In this study, the specialist physician can function in different modes. These modes involve three different sites for service delivery, and may or may not involve alternative means of delivering specific health services. For purposes of this study, there are three different forms in which the patient visit can occur: in the hub clinic, at the outreach clinic, or via telemedicine. When the patient visits the hub clinic, the physician is located in an examination room at the hub; similarly, when the patient is examined via telemedicine, the physician remains at hub, but utilizes one of the telemedicine sites located there instead of an examination room. The assumption here is that there is no measurable travel time for the physician associated with this different location at the hub. When examining the direct costs associated with the use of
telemedicine as a form of encounter, the primary contrast, therefore, will be with the outreach clinic. The difference in the psychological and behavioral aspects of the encounter will also be considered, although attempting to quantify those aspects is problematic.

Figure 2 provides an opportunity to explore three varying forms of patient-physician interaction. There are three different nodes (locations) identified. The first is referred to as hub clinic, located in the hub community. When the patient-physician interaction takes place at this node, both the patient and physician must travel to that node, as denoted by the arrows with a label 1. Interactions between the physician and patient at this location take the form of both initial visits, and follow-up encounters.

The second possible point of interaction between the physician and patient is the outreach clinic. The arrows labeled 2 indicate that both the physician and patient travel to
that geographic location, for a face-to-face encounter. In this instance, the physician normally travels a greater distance than the patient to get to the point of interaction. This occurs because most outreach clinics are located in rural communities in order to bring services to the patient. The outreach clinic is also the site of both initial and follow-up visits. Physicians are willing to travel to these communities for a variety of reasons, including improved access to the local community, and increased marketing of services, resulting in increased market share.

The third site of interaction is the telemedicine site. As indicated, at least in the current study, the telemedicine encounter was used only for follow-up visits. (As comfort levels improve, and as technology results in improved resolution and expanded capabilities, it is assumed usage will increase.) As denoted by the solid arrows labeled 3, the patient travels to the telemedicine site, while the physician travels to the hub clinic, where the hub telemedicine equipment is located. Usually, there is minimal additional travel involved for the physician in this mode, since the telemedicine examination room is located in close proximity to the face-to-face examination rooms in the facility. In some cases, the physician may have the telemedicine equipment in his/her office. Desktop personal computers may substitute for telemedicine equipment in the future, on a more regular basis, due to technological improvements and reduced cost. The patient would generally have minimal additional travel beyond that necessary to get to the out-reach clinic site. The dotted double-arrow line labeled 3 indicates the communication that takes place via the telecommunications equipment. This communication can take a variety of forms, including audio, video, radiography, etc.
Location of Study

The clinic used in this study is located 90 miles from the hub. The cardiologist involved saw numerous patients in one of three locations or modes: at the hub clinic, at the outreach clinic, or via telemedicine. While actual clinical resources used were similar in each situation, the use of other resources varied dramatically, depending on the locus of the visit. One of the major resources involved is time. Economists often discuss the value of time. It could be argued that, regardless of the other direct and indirect costs included in this analysis, the value of the physician’s time is greater than that of the patient, especially if the patient is unemployed or retired.

When the visit took place at the hub clinic, the physician was able to stay in the clinic, see the patient just like any other patient, have access to all the resources of the teaching hospital, and make no adjustments in his/her daily routine. The patient, on the other hand, bore the majority of indirect costs of the encounter, by having to take time off work (if not retired), having to take the time and make the effort to travel, navigate a new and different community, and occasionally, remain in the hub city overnight. Sometimes, this would mean that an additional caregiver would have to accompany the patient, doubling the time cost and other items mentioned in the previous sentence.

When the encounter took place at the outreach clinic, many of the non-medical costs were shifted to the physician (and, therefore, to the hub clinic). The physician had to travel to the outreach clinic, spending time on the road, time that might otherwise be used seeing patients, performing research, or being involved in continuing medical education endeavors. The number of patients seen by the physician in the outreach community is reduced, due to the time spent on the road, unless the work day is extended. The patient
bears minimal costs in this scenario, due to the close proximity of the clinic to his/her place of living and working. There may be no need for the assistance of another caregiver. And, if there is, the time of assistance is greatly reduced. In this study, only those costs most directly related, and captured, by the specialty clinic were assessed.

Finally, when the encounter takes place via telemedicine, the costs become more evenly distributed, as do the benefits. The physician travels to his/her daily place of work, with the capability of seeing both telemedicine and non-telemedicine patients. There is no lost time for travel or other costs associated with travel to the outreach clinic. The patient, generally, has a shorter distance to travel, which may result is less lost work time, earlier encounter in time, and, perhaps, earlier diagnosis and treatment.

**Cost Identification**

The following discussion illustrates the method used to examine the financial implications of alternative modes of health services delivery. Activities of the different parties to the transaction were examined in each mode. The objective was to identify where costs were different (the marginal costs associated with the intervention), not the total costs of each mode of delivering cardiology services. Costs were then assigned to each of these different activities in order to determine the financial impact of each transaction. The financial implications were examined relative only to the specialty clinic. Thus, the following scheme was used to examine the costs.

**Scenario 1:** Physician-patient interaction took place at the hub clinic. This is the base case. Base-case information includes the number of patients seen by the physician during a typical day, how much time is spent with patients, how much time is spent with
other duties, average compensation of the physician, and average revenues generated per patient. Since the focus is on the specialty clinic, no costs are assigned to the patient.

**Scenario 2:** The physician-patient encounter took place at the outreach clinic. In this case, the physician (and the physician’s office) is required to prepare for the visit, spend time traveling to the outreach clinic, see patients at the outreach clinic, then return to the hub community. Essentially, some of the costs of the transaction are shifted from the patient to the physician. For purposes of this study, the primary impact is the travel time, during which the physician could not see patients or perform other duties. Regardless of how the physician is paid, there is a cost in terms of lost productivity.

**Scenario 3:** The physician-patient encounter took place via telemedicine. In this case, neither the patient nor the physician is required to travel, except to the telemedicine site. The physician is able to “see” the patient in a normal examination room, which can be a room right next door to where face-to-face patients are seen.

Given the description of scenarios 1 and 3, it is seen that the consequences for the physician of these two situations are very similar. Neither requires the physician to leave the hub clinic. The only difference, from the standpoint of the clinic, is the form of the interaction.

In assessing the financial implications, a generic spreadsheet model was developed that permits different clinics, different specialties, and different communities to be examined. One section of the model in the spreadsheet determines the travel costs when adjusted for distance, meals, and any other direct costs associated with the travel. An illustration of the spreadsheet used in this study is presented in Appendix A.
This spreadsheet was developed to be very flexible. That is, it is designed in such a way that any specialty can be explored, as well as any geographic location. The spreadsheet has three sheets—the first is a summary page with the final calculations. The second sheet has the required data regarding the physician specialty, including pay scales, productivity, patient contact time, total worked hours, etc. The third sheet collects data about the remote community relative to the hub community, including distance, travel time, etc.

**Data**

A single cardiologist was utilized to illustrate the model. The cardiologist selected had been using telemedicine for several years, was comfortable with its use, and had developed a routine for its use in the practice. A single rural community was used to illustrate that portion of the model; it is located 90 miles from the hub clinic. The process of a patient encounter was examined to determine the changes that were needed when a telemedicine visit was used in place of an outreach clinic. This examination showed that a nurse was involved in the transaction, regardless of the encounter mode. Therefore, the cost of this nurse was not included in the study, although an issue might arise as to who pays for the nurse’s service. The nurse involved in the majority of the telemedicine visits was interviewed extensively, in order to learn the extent to which a telemedicine visit differs from a face-to-face encounter, and to determine the process used for the telemedicine visit.

Additional information needed in estimating the financial implications included travel time, preparation time, compensation, productivity, time spent with patients, average
In addition to teleconsultation times, etc. These data were taken from the MGMA reports. In should also be noted that only non-invasive cardiology data were used in deriving these estimates, since telemedicine was not used for invasive procedures in this practice.

Results

Examination of the data described above results in a daily opportunity cost of $2,301 for a cardiologist visiting an outreach clinic at the rural site. It is important to recognize the impact of the assumptions on this value. National data were used for compensation, production, patient contact hours, and other variables, as listed in Appendix A. Included in this appendix are copies of the spreadsheet used to calculate the opportunity cost. The first page of the spreadsheet provides summary data and calculations, resulting in the $2,301 cost to the clinic. The second and third pages provide the data used to calculate these costs. A more complete description of the data elements is included after the spreadsheets.

This study provided a great deal of valuable information regarding the process involved in a telemedicine visit, factors that are considered in the decision to have a telemedicine visit, and the process involved at each end of the transaction. Some of these are not unique to telemedicine, but do require additional coordination due to the distance involved. For instance, the cardiologist included in this study indicated that, in his practice, an initial visit for a cardiology patient would never be via telemedicine. The physician believed that it is extremely important that a personal relationship be established with the patient before permitting geographic distance to be introduced into the equation. This

particular physician also would not see the same patient twice in a row via telemedicine. This does not mean that quality of care would be compromised with two sequential telemedicine encounters, but that this physician preferred retaining personal contact on alternating visits.

The process of the encounter involved substantial communications with the nursing staff at the telemedicine site, in order to ensure that appropriate tests were performed, the results were available, and all equipment was functioning properly for the encounter. The activities are not unique to the telemedicine encounter and involve support staff rather than physician time, but the telemedicine encounter is dependent upon no communication failures occurring.

In this practice, telemedicine patients were scheduled for 15-minute appointments. In general, the number of individuals (the physician, the patient, and a nurse) involved in the encounter was identical, simply located at different places. The amount of physical space required, however, is increased. This increase is due simply to the fact that two physical locations are required. Convenience for the physician might be enhanced since he/she can now be in his/her own office, as opposed to an examination room. The hub site will probably entail the patient and nurse being located in an examination room. At the present time, however, the hub clinic is not required to pay for that space in the rural community, so it is not included in the cost equation. The model is designed, however, to enable such costs to be incorporated with minimal changes. As long as the telemedicine equipment is located at rural hospitals, and the benefits associated with its availability are recognized, the rural hospitals and clinics should continue to be willing to provide space—especially if the hub clinic is supplying the technology.
For the community involved, located 90 miles from the hub community, using cardiology-specific cost data, an incremental cost of $2,301 per day was derived. What this means is that a physician traveling to an outreach clinic, as opposed to utilizing telemedicine, is costing the clinic $2,301 in additional revenue for that day. At this time, it is not known to how many days this amount should be applied. This cost figure is based on an average work day, assuming that at least some of the time spent on the road would have been utilized to see patients, generating an average amount of productivity (revenues).

No costs were ascribed to the telemedicine equipment. This equipment is shared by all clinics and available to the rural areas. The issue of payment for these resources is yet to be determined. It is important to note, that costs have declined dramatically over the course of this project, making payment for equipment a less important issue in the future than it was in the past. The RTEP/RTGP evaluation team has discussed this issue elsewhere. No incremental costs are ascribed to the location of the performance of lab tests, pharmaceuticals, etc. Based upon discussions with the cardiologist, it was found that the use of telemedicine did not generate additional orders for ancillary services.

A nurse was also involved, regardless of the setting. The time associated with the nursing duties did not appear to differ according to site of treatment, so total nursing cost is not expected to change. However, the organization bearing the nursing cost does change, so this resource use must be considered. While the total cost of nursing activities may stay the same, the location of the cost is not irrelevant. In addition, any prescriptions, education, or other activities that take place as a result of the examination will take place at

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the rural site, as opposed to the hub clinic. An implicit assumption is that the activities would have taken place regardless of the location of the examination. While the total costs associated with the encounter may not change, the location is relevant to the organizations, especially if their ownership is unrelated. Transfer of funds will need to be considered, as well as regulations permitting or prohibiting such transfers (fee splitting, kickbacks, self referral, etc.).

**Discussion**

This study is one of the first to explore the specific financial implications of a specialty clinic involving the use of telemedicine. The specific specialty was cardiology. These results will vary according to the average reimbursement per patient, and the average number of patients to be seen in a day. The acceptability of telemedicine as a substitute for a face-to-face encounter is dependent on a number of factors. For instance, if the decision to use telemedicine is based on quality and technical considerations only, the potential benefits to be derived are believed to be much greater than have been realized so far. On the other hand, many physicians believe that the healing hand must be given in person, for the encounter to be meaningful, appropriate, and correct. The psychological barriers associated with the use of telemedicine are sure to exist on both sides—physician and patient. If the physician is not confident in his/her ability to diagnose accurately and treat a patient appropriately via telemedicine, then this mode of encounter will not take place.

In terms of the current study, where the physician is salaried and assumed to be fully utilized by the organization, a cost impact of $2,301 for one physician for one day is not insignificant, especially in today’s environment of tightening reimbursement. No
attempt is made to determine how many days’ worth of visits might be avoided through the use of telemedicine. However, if 10 days of travel are avoided, the difference will pay the wages of a clerical staff; if 20 days are avoided, an RN can be hired. It is obvious from the numbers, that the use of telemedicine as a substitute for the outreach clinic has financial advantages.

Outreach clinics provide an advantage to the patients by having easier access, an advantage to the hub clinic by expanding market share, and to some extent, serving as a feeder for the hub hospital. Consideration must be given to the extent to which outreach clinics provide services to individuals who would not otherwise receive those services, who would not make the trip to the hub, who might receive delayed diagnosis, or might experience an avoidable traumatic experience.

While this study is primarily concerned with the direct impact on the clinic, the impact of telemedicine on the patient should not be ignored. The patient does not have to travel to the hub clinic, and may not have to lose as much work time. These are benefits of telemedicine not captured by most evaluation studies, including this one.

The quality of the interaction might also be impacted by the use of telemedicine. Assumptions regarding the quality of the interaction come about from the willingness or unwillingness of the physician to utilize telemedicine in a specific instance. The physician is concerned from a technical standpoint, in terms of being able to perform an accurate assessment of the individual, and provide appropriate and timely advice and treatment.

The patient would like to have the physician come to them, while the physician would rather have the patient come to his/her location. Telemedicine permits both the patient and the physician to remain where they are. So, each should recognize a benefit
associated with this fact. This benefit, on the side of the patient, should result in a willingness to incur more physician contacts, permitting earlier diagnosis and intervention, and, perhaps, improved compliance. This will enhance the impact of the physician’s treatment and intervention. The potential downside on the part of each include: lack of a personal, hands-on experience, no face-to-face contact; another, third party, involved in the examination (the nurse at the remote site); and possible lack of access to appropriate technology for testing at the remote site. This last might result in two visits serving the function of one. However, without the first, the second may not have been necessary.

Access to health services is provided to the patient. This is one objective of the outreach clinics. Improved access should result in earlier intervention and reduced initial contact through the emergency room. In a managed care environment, this improved access is desirable from the standpoint of the physicians, since earlier and more appropriate utilization will reduce health care costs. In non-managed care, improved access will increase market share, thereby increasing revenues.

There are at least two issues that appear problematic relative to this case study. First is the physician’s choice to only do follow-up visits via telemedicine. Telemedicine has been used in Greece for a number of years, in an environment where weather and numerous islands combine to make travel unpredictable at best. One report indicated that cardiology interactions were performed with a general practitioner on one end, and the specialist on the other. Of the 1,946 patients involved in this study, 681 (35%) presented with cardiology problems. The benefits identified with this intervention included better access to cardiology specialists, improved decisions about patient transportation, a

reduction in isolation, and continuing professional education. A similar study performed in Great Britain found 81 percent of telecardiology patients to be suitable for management entirely by the general practitioner, without the need for referral to hospital (where the specialists are located). A major benefit realized by the general practitioners in the study was the capacity to remain in control of patient management. Benefits found in this case were “earlier interventions, permitting management by the GPs, increasing GPs clinical and management skills, and enhancing the knowledge of both GP and specialist through increased interaction with each other.” There may be benefits to the use of telemedicine that has not yet been attempted in the US markets.

**Conclusions**

It is obvious that there is a financial advantage to the use of telemedicine to the cardiology clinic at the hub. There are three different ways in which the physician and patient can interact – face to face in the outreach clinic; face-to-face in the hub clinic; or via telemedicine with the physician located at the hub, and the patient located at the rural site. If the patient travels to the hub site, there is no opportunity cost to the physician or the clinics. Any costs of inconvenience, lost work, travel, etc., are borne by the patient, and are normally considered irrelevant to the physician and clinics. This is considered to be the baseline. If the physician travels to an outreach clinic, then the physician and hub clinic bear most of the costs associated with convenience, travel time, lost work time, etc. The third case, the use of telemedicine, provides a financial advantage to both parties involved in the transaction—the physician and the patient. This study captured the financial advantage to the physician and the hub of using telemedicine. There was, however, no

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attempt to place a cost on the telemedicine services. There are also financial advantages
to the patient, which have not been included in this model.

The savings of $2,301 for the use of telemedicine for one day, as opposed to
traveling to an outreach clinic located 90 miles away, is only an estimate. It does not
include a cost associated with the compensation of the physician involved. This might be
considered to be a sunk cost, since it is paid regardless of what the physician does with
that time. The above value is understated to the extent that it assumes only non-invasive
visits are made via telemedicine. Since it is used primarily for follow-up visits, it is just as
likely that these are invasive follow-ups. Therefore, a higher value should be assigned to
both the lost production and the gained production via telemedicine.

As the above discussion indicates, there are a number of issues that need further
investigation, if the full value of telemedicine is to be established. The model developed in
this paper contributes important information to one aspect of the value, illustrating the
types and sources of data needed to measure the value of telemedicine to a hub location.
Additional study is needed to quantify the value to the outreach site, the patient, the
communities in which the equipment is located, and society. Further investigation is also
needed into the reallocation of costs and reimbursement of those costs among the parties
involved in the transaction.
APPENDIX A:

SPREADSHEET MODEL FOR CALCULATION
OF CARDIOLOGY CLINIC OPPORTUNITY COST--
SUBSTITUTION OF TELEMEDICINE FOR
OUTREACH CLINIC
For Cardiology, Telemedicine as Substitute for Outreach Clinic Visit:

Assumptions:
1. Total time spent travel and seeing patients is same as time spent seeing patients if no travel, up to max per day patient contact time.
2. Only non-invasive patients seen via telemedicine.
3. All compensation assigned to patient contact time.
4. Production at clinic assumed to be equally distributed between invasive and non-invasive, when considering use of time in clinic.
5. Cost is calculated by adding direct travel costs plus lost production minus an assumed production generated by the telemedicine patients.

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<tbody>
<tr>
<td>1</td>
<td>Travel</td>
<td>$60.65</td>
<td></td>
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<tr>
<td>2</td>
<td>Direct Cost</td>
<td>$60.65</td>
<td></td>
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<tr>
<td>3</td>
<td>Time</td>
<td>5.7</td>
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<tr>
<td>4</td>
<td>Time spent with patients via telemedicine</td>
<td>1 hour</td>
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<tr>
<td>5</td>
<td>Patients seen via telemedicine</td>
<td>4</td>
<td></td>
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<tr>
<td>6</td>
<td>Total time involved in travel and seeing patients</td>
<td>6.7</td>
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<tr>
<td>7</td>
<td>Average patient contact hours per day</td>
<td>5.72</td>
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<td>8</td>
<td>Patients Seen Per hour</td>
<td></td>
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<tr>
<td></td>
<td>Non-Invasive</td>
<td>1.43</td>
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<tr>
<td></td>
<td>Invasive</td>
<td>1.13</td>
<td></td>
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<tr>
<td>9</td>
<td>Patients not seen at clinics:</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>Non-Invasive</td>
<td>8.19</td>
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<tr>
<td></td>
<td>Invasive</td>
<td>6.46</td>
<td></td>
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</tr>
<tr>
<td>10</td>
<td>Production not generated at clinic:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Non-Invasive</td>
<td>$2,715.41</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>Invasive</td>
<td>$3,790.60</td>
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<tr>
<td>11</td>
<td>Compensation not generated at clinic:</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>Non-Invasive</td>
<td>$1,058.04</td>
<td></td>
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<tr>
<td></td>
<td>Invasive</td>
<td>$1,420.56</td>
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<td></td>
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<tr>
<td>12</td>
<td>Production generated via telemedicine:</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>Non-Invasive</td>
<td>$474.94</td>
<td></td>
<td></td>
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<tr>
<td>13</td>
<td>Compensation generated via telemedicine:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Non-Invasive</td>
<td>$185.06</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Cost per day of cardiologist visiting outreach clinic as opposed to using telemedicine for one hour:</td>
<td>$2,301.11</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>Cost per day when considering travel time and compensation distributed over patient contact hours as cost for non-productive time.</td>
<td>$933.63</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Data by Specialty: Cardiology

Shaded values are calculated.

1. **Production:**
   - Non-Invasive: $640,836
   - Invasive: $894,581

2. **Compensation:**
   - Non-Invasive: $249,697
   - Invasive: $335,252

3. **Salary (average compensation):** $292,475

4. **Ratio of Compensation to Production:**
   - Non-Invasive: 38.96%
   - Invasive: 37.48%

5. **Encounters per year:**
   - Non-Invasive: 1,934
   - Invasive: 1,524

6. **Patient contact percent:** 58.7%

7. **Average Hours Worked/Wk:** 48.7

8. **Patient Contact Hours/Week:** 28.6

9. **Patient contact hours/day:** 5.72

10. **Average weeks worked per year:** 47.2

11. **Total hours patient contact/yr:** 1,349

12. **Total worked hours per year:** 2,298.64

13. **Time spent per patient:**
   - Non-Invasive: 0.70
   - Invasive: 0.89

14. **Patients seen per hour:**
   - Non-Invasive: 1.43
   - Invasive: 1.13
   - Average: 1.28

15. **Production per visit:**
   - Non-Invasive: $331.35
   - Invasive: $587.00
   - Average: $459.17

16. **Compensation per visit:**
   - Non-Invasive: $129.11
   - Invasive: $219.98
   - Average: $174.55

17. **Production per hour:**
   - Non-Invasive: $474.94
   - Invasive: $663.00

18. **Compensation per hour (contacts hours):**
   - Non-Invasive: $185.06
   - Invasive: $248.46

19. **Compensation per hour (total hours):**
   - Non-Invasive: $108.63
   - Invasive: $145.85
<table>
<thead>
<tr>
<th></th>
<th>Data by Location:</th>
<th>Rural Community</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Distance from Hub Clinic to:</td>
<td>93.3</td>
</tr>
<tr>
<td>2</td>
<td>Travel time from Hub Clinic to:</td>
<td>2.35</td>
</tr>
<tr>
<td>3</td>
<td>Preparation Time (15 minutes both sides)</td>
<td>0.5</td>
</tr>
<tr>
<td>4</td>
<td>Total time one way:</td>
<td>2.85</td>
</tr>
<tr>
<td>5</td>
<td>Round Trip time</td>
<td>5.7</td>
</tr>
<tr>
<td>6</td>
<td>Miles, round trip</td>
<td>186.6</td>
</tr>
<tr>
<td>7</td>
<td>Rate per mile</td>
<td>$ 0.325</td>
</tr>
<tr>
<td>8</td>
<td>Mileage Cost</td>
<td>$ 60.65</td>
</tr>
</tbody>
</table>
The following presentation of the variables involved in the calculation will start with the second spreadsheet. The first page is the summary page providing the results of applying the data demonstrated on the next two sheets.

The second sheet of the spreadsheet model includes a variety of data that may or may not be relevant to the cost determination. Cardiology data include the following:

1. Production – Non-Invasive and Invasive: These data represent the dollar value of services provided by cardiologists over a period of a year. Production is the value of the services provided, including visits, tests, and surgeries. The non-invasive and invasive refers to the physicians, not all of whom do surgery. While only non-invasive data were used in the cardiology calculation, both are included in the model for completeness, and flexibility when applying to other specialties.

2. Compensation – Non-Invasive and Invasive: These data represent the average compensation of physicians over a period of a year, for those doing surgery and those not doing invasive procedures.

3. Salary: In this case, we have used the arithmetic average of the non-invasive and invasive compensation. If additional data become available regarding the relative numbers of non-invasive versus invasive, these ratios will be used to determine average compensation and average production.

4. Ratio of Compensation to Production: at the current time this figure is included more for information, than for input into the cost calculation. It is the relationship between the number of dollars generated by a physician relative to the number of dollars that the physician receives in compensation.

5. Encounters per year: These data indicate the number of encounters by type, incurred over a period of a year, by a typical non-invasive and invasive cardiologist.

6. Patient Contact Percent: This number indicates the national average proportion of cardiologist time which is spent in direct patient contact. The remainder is assumed to be related to administrative and other duties and responsibilities, including billing, transcribing, etc.

7. Average hours worked per week: This number has been decreasing slowly over time.

8. Patient Contact Hours/Week: This is calculated by multiplying the average hours worked per week (7) by the patient contact percent (6).

9. Patient Contact Hours/Day: This number is found by dividing the number in (8) by five, the assumed number of work days in the week.
10. Average weeks worked per year: This value has been determined by survey, and is used to determine the average number of hours worked per year.

11. Total hours patient contact/year: This value is determined by multiplying the Patient Contact Hours/Week (8) by the average weeks worked per year (10).

12. Total worked hours per year: This value is determined by multiplying Average hours worked per week (7) by the average weeks worked per year (10).

13. Time Spent per patient: This value is divided into non-invasive and invasive. Values are calculated by dividing Total hours patient contact/yr (11) by Encounters per year (5).

14. Patients Seen Per Hour: Calculated by dividing Total Hours patient contact/yr (11) by Encounters per year (5).

15. Production per visit: Calculated by dividing Production (1) by Encounters per year (5).

16. Compensation per visit: Calculated by dividing Compensation (2) by Encounters per year (5).

17. Production per hour: Calculated by dividing Production (1) by Total hours patient contact/yr (11).

18. Compensation per hour (contact hours): Calculated by dividing Compensation (2) by Total hours patient contact/yr (11). This figure is based on the idea that compensation should be divided only over those hours during which the physician is generating revenues through direct patient contact.

19. Compensation per hour (total hours): Calculated by dividing Compensation (2) by Total worked hours per year (12). This figure is based on the assumption that compensation is associated with all the activities of the physician, not just direct patient contact time.
The third page of the model provides data regarding travel to the outreach clinic site. This travel is avoided to the extent that telemedicine can be used as a substitute. The data provided initially involves the outreach clinic in this study. Data were provided by one of the many mapping software programs, so is based on averages.

1. Distance from hub to: This page will include distance data for each of the telemedicine sites.

2. Travel time from hub to: These data are provided by the mapping program, is usually somewhat conservative, but are believed relevant when considering time for automobile pickup, gassing, food stops, etc.

3. Preparation time (15 minutes both sides): This is an assumption to account for some down time on both sides of the trip, time used for preparation of any materials, the mental disconnect that must take place with whatever was taking place prior to the travel, etc.

4. Total time one way: This is the sum of (2) and (3), travel time plus preparation time.

5. Round Trip time: This is twice (4)

6. Miles, round trip: This is twice (1)

7. Rate per mile: This is the current IRS rate, which includes gas, depreciation, routine maintenance, etc.

8. Mileage Cost: This is the product of Miles, round trip (6) and Rate per mile (7).
Finally, returning to the first page of the spreadsheet, data from the second and third pages are used to calculate the cost to the clinic, of having an individual drive to the outreach clinic, as opposed to using the telemedicine resources.

It is important to recognize the assumptions that are made in determining this cost. For completeness, the assumptions are repeated here:

1. Total time spent travel and seeing patients is same as time spent seeing patients if not travel, up to max per day patient contact time. This means that it is assumed that the work day of the physician who stays at the hub is not longer than the average time of normal patient contact, even though travel time might lead to a longer day.

2. Only non-invasive patients seen via telemedicine. This is from current usage, meaning that telemedicine is used only for follow-up.

3. All compensation assigned to patient contact time.

4. Production at clinic is assumed to be distributed equally between invasive and non-invasive, when considering use of time in clinic.

5. Cost is calculated by adding direct travel costs plus lost production minus an assumed production generated by the telemedicine patients. Thus, it is assumed that non-invasive production generated via telemedicine is identical to the production that would be generated in the clinic over the same time period.
EVALUATING TELEMEDICINE:
A COMPREHENSIVE TELEMEDICINE EVALUATION MODEL

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Barry Kling, M.S.P.H.
Joe Tracy, M.S.
Joyce Mitchell, Ph.D.
Weldon Webb, M.S.

August 9, 1999

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Telecommunications and advanced information technologies have increasingly been used for clinical activities, education, administration, and research to improve health care delivery. Telemedicine was first used in the United States by NASA, during the 1960s.\textsuperscript{1} Since then, its use has increased dramatically, to an estimated clinical usage of 250,000 diagnostic teleradiology studies and 46,200 interactive video and store-and-forward teleconsultations in 1997.\textsuperscript{2} With this growth in use, these technologies have been the recipient of many investigations to evaluate their effectiveness and efficiency. These evaluations are extremely important for the future of telemedicine. The impact of telecommunications on the cost, quality, and access issues of the health care industry will determine the extent to which the potential of these technologies is realized. Thus, it is important for telemedicine to be aggressively evaluated on a continuing, expansive, appropriate, and comprehensive basis. However, as reported elsewhere,\textsuperscript{3,4,5,6} many evaluative investigations have been incomplete, or have applied inappropriate techniques.


in the evaluation process, especially when attempting to evaluate the cost effectiveness of medical technologies.

Because of the wide diversity of activities involved in telemedicine, it is critical that a systematic framework be developed for use in evaluating the effectiveness, efficiency, and feasibility of telemedicine. Historically, clinical trial research in medicine has focused on the issues of safety, efficacy, and effectiveness of medical technologies. Recently, medical research has been broadened to include economic feasibility and implications. As the content expands, researchers have to incorporate additional theories and tools, and research teams truly become interdisciplinary. This especially occurs in medical evaluation research, which is focused on determining not only the clinical impacts, but also the economic implications of the alternative interventions. Such evaluation requires not only the tools of clinical trials, but also the tools of economic impact analysis.

The basic underlying concept of evaluation is the determination of the consequences of an intervention. Evaluations can be prospective–based on past events and reactions to those events, what would probably happen if a specific event occurred–or retrospective–what changed after an event or intervention occurred. In a clinical setting, evaluation attempts to determine what occurs either in the prevention, diagnosis, treatment, or eradication of a particular disease or illness with the application of a

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particular medication, procedure, device, or behavior modification strategy.\textsuperscript{11} Economic evaluations add the determination of the resources that would have to be expended to implement the intervention. As this discussion indicates, an economic evaluation attempts to determine the costs and consequences of a particular action.

**Theoretical Foundation of the Evaluation Project**

Any evaluation project must have a theoretical foundation. This theoretical foundation will focus and direct the thought process associated with examining the myriad of dimensions involved. This need for a theoretical foundation is especially true in the case of telemedicine, given the complex natures of health and health care. Examination and evaluation of health, health care, and the health care system is extremely complex, in and of itself. When telemedicine is superimposed on this system, the complexity is exponential. Therefore, to make evaluations manageable and replicable, there has to be a structure placed on the evaluation.

The primary theoretical foundation involved in the development of the comprehensive telemedicine evaluation model presented in this paper is transactional economics, more often referred to as transaction cost economics.\textsuperscript{12} The basis for using this foundation is that the health care system is composed of multiple transactions—between physicians and patients, between physicians and physicians, between hospitals and physicians, between hospitals and patients, between patients and patients, between patients and employers, between physicians and payers, between hospitals and payers, and between patient and payers. The list of parties interacting in the health care system is


much longer, of course. But, the main idea is that there are numerous individuals and organizations involved in the production of health and health care services, many of whom interact (perform transactions) with each other on a continuing or periodic basis. These transactions drive the quality, cost, and access associated with the system.

Now, superimpose a telecommunications structure on top of many of these transactions, and it can easily be seen that the scope and complexity of these transactions are modified, magnified, or changed in some way. With the introduction of telemedicine, the nature of the previous interactions involved in the episode of care requires a change in the transaction. The evaluation model must now examine the extent to which the changes in the transactions result in an improvement or deterioration in the health of the population, the cost associated with that level of health, and the access stakeholders have to that system.

A recent article by Hagel and Singer\textsuperscript{13} expanded the concept of transaction costs to include the costs of exchanging ideas and information, and have referred to this concept as interaction costs, rather than transaction costs. Since the introduction of telemedicine into the health services equation has a definite impact on the exchange of ideas and information, this reference to interaction cost economics might be a more accurate representation. However, this is strictly semantics, and the authors of this paper assume that the terms transaction costs and interaction costs can be used interchangeably.

Another way of looking at the introduction of telemedicine into the health services equation is through its impact on transactional distance. This concept of transactional distance is used primarily in conjunction with distance education, but is relevant to any

transaction or interaction.\textsuperscript{14} Transactional distance refers to any factor having an impact on the interaction that creates distance between the parties—education, knowledge base, culture, ethnicity, gender, health status, etc. Geography creates an additional distance, through time and space. When parties are geographically dispersed, there can be substantial costs associated with traveling to a mutual location where the exchange can occur. It is then incumbent upon the parties to the transaction to minimize the transactional distance to the extent possible. The value of the transaction will be enhanced with the reduction of this distance.

Organizations and structures evolve in such a way as to minimize the costs of the transaction or interaction. To achieve this cost minimization, it is important to identify the various costs, as well as the benefits (gains), associated with the interaction. In the efforts to minimize costs, there are a variety of ways to organize transactions, depending on the goal of the analysis. There are, at least, five types of transaction attributes that play important roles in the development of the analysis:\textsuperscript{15}

1. The specificity of the investments required to conduct the transaction.
2. The frequency with which similar transactions occur, and the duration or period of time over which they are repeated.
3. The complexity of the transaction and the uncertainty about what performance will be required.
4. The difficulty of measuring performance in the transaction.
5. The connectedness of the transaction to other transactions involving other people.


All of these attributes are appropriate for, and applicable to, the evaluation of telemedicine. There are massive investment requirements to be made, although it is difficult to identify exactly who should make the investment. The ambiguity arises due to the difficulty in identifying the ultimate consumer—Is the consumer the patient, the physician, the hospital, the insurer, the community, or society? In reality, it is all of these stakeholders, making it difficult to get any one of the parties to pay for the required investments. Also causing difficulty with identifying, quantifying, and assigning the cost of the technology to the appropriate stakeholder is that all of the benefits associated with its use cannot be captured by any single party to the transaction. This multi-product phenomenon raises an issue of charging (pricing) for the use of the technology, especially in the situation where an independent (private) entity might desire to provide the technology and sell it on a subscription basis. This pricing issue is not developed here, but is dealt with in an additional manuscript\textsuperscript{16} prepared by the RTEP/RTGP team.

The frequency and duration of the transactions associated with telemedicine are difficult to anticipate. Some uses of the technology are predictable; others are not. For example, emergency department use is the most difficult to plan and predict, while routine specialist follow-up encounters are much more easily predicted, as are educational uses of the technology.

The last three transaction attributes listed earlier probably cause the most difficulty. The complexity of the medical encounter has been discussed elsewhere. The complexity is increased through the introduction of one more distance factor into the interaction. This increase in complexity might be totally real or partially imagined, as change in the

encounter is anticipated. While the actual reality may not meet the expectations, change is always worrisome—especially in the case of health services. Change introduces uncertainty and risk into the equation. The risk and uncertainty is due to a change in the interaction—perhaps more psychological than not. As previous research has demonstrated,\textsuperscript{17,18} the technology, assuming there are no malfunctions, permits visual and audio interactions at the same level, if not better, than when performed in a physical face-to-face encounter.

An additional risk, or change, results from the statement in the previous sentence “…as long as it works.” There are still some risk and uncertainty involved with the use of new technologies that do not have 100 percent reliability. As long as there is the possibility of data and information interruption, thereby interfering with the interaction, acceptance of the technology will be delayed. Similar interference takes place, however, as long as flat tires, mechanical problems, and weather related travel interruptions work to prevent a patient’s clinic visit.

Likewise, even without telemedicine and telecommunications technology, the issue of performance, or quality measurement, plays a major role. The interaction through the technology creates some anxiety on the part of both parties to the encounter regarding the ability to ensure the quality of the interaction. In some cases, it may be necessary to provide clinical trials in order to ensure that quality is not compromised. Once again, quality measures, the use of clinical trials, and evidence-based medicine, are all relatively recent phenomena. The increase in transactional distance through the introduction of


telemedicine adds only one more layer of complexity to the equation, making evaluation more difficult.

Finally, the connectedness of the transaction to other transactions, encounters, or interactions involving other people, has obvious applications to telemedicine. The medical encounter often requires testing of various sorts and consultation with other individuals, and, in the case of interactive video telemedicine, at least one professional on each end of the camera. Coordination of these geographically dispersed activities also tends to increase the complexity, and must be considered during the evaluation phase.

All the above considerations must be included in the development of an evaluation plan. The next section presents the model that was developed from the above considerations and attributes.

**The Comprehensive Model**

One of the first steps in any economic analysis is to identify the perspective involved in the analysis. As the Missouri Rural Telemedicine Evaluation Project/Rural Telemedicine Grant Program (RTEP/RTGP) team explored the different evaluation studies that could be performed, it became obvious that a structured approach would be required if all of the perspectives were to be identified. While it would be impossible for the RTEP/RTGP team to perform a single, comprehensive evaluation, including all aspects of a required analysis, the development of a comprehensive evaluation model played an integral role in the selection and structure of the numerous evaluation projects that were performed. This model assisted in identifying the strengths and weaknesses of the completed evaluation, and provided a framework for identifying those areas in need of further examination. In this process, the RTEP/RTGP team identified three specific
dimensions that would need to be considered in an evaluation: level of analysis, focus of analysis, and activities of analysis.

**Level of Analysis**

The first dimension to be considered might be called the level of analysis. Three broad levels of analysis can be initially identified – individual, community, and society. It is extremely important to identify the level at which the analysis is to take place, in order to ensure that the appropriate benefits and costs are being captured. Conclusions regarding the acceptability of the intervention may vary substantially among the levels. Indeed, it is almost certain that all the benefits associated with telemedicine cannot be captured at the individual level; benefits and/or costs accrue to others besides the individuals involved directly in the transaction or encounter.

**Individual Level**

At the individual level, concern is focused strictly on the direct benefits and costs associated with the individual and his/her concerns. Without placing a value judgment on the breadth of individual concerns (although, in practice, this may be needed in a particular instance), it should be obvious that individual concerns will be somewhat narrower than that of the community, as a whole. At the individual level, the concerns are: “what will it cost me and how will I benefit (gain) from the exchange."

**Community Level**

The second level of analysis is the community. A community is loosely defined as a group of people who occupy an analogous location in social, economic, or institutional structures. A community is not simply limited to geographical boundaries, but rather it is comprised of a complex network, intertwining the political, social, and economic relationships within a group of people. These groups, by definition, pursue common
interests and objectives, often exchanging ideas, goods, and services in an effort to obtain those goals. These goals strive to better the well-being of the community, as a whole, and not simply certain individuals within a community. A community consists of a common bond—a web connecting all members and components of the community to each other. Thus, a community is more than the sum of its parts. As each individual piece is placed in the community puzzle, a new whole is created—one able to overcome former obstacles blocking individuals. Thus, community issues may not directly reflect individual interest; however, such issues will directly affect each individual within the community. For economic analysis, the economic impact on a community is generally much greater than the sum of the impacts on the individuals.

Due to the close-knit, interconnected nature of a community, the general health of its members has a major effect on the well-being of the community’s social and financial institutions. For example, the production function of a community is impacted by the extent to which its members are able and willing to purchase health care and other major lifestyle commodities in the local market. This phenomenon makes it exceedingly difficult for the community to measure accurately the benefits and costs associated with medical interventions. Similar problems arise when attempting to evaluate the impact the implementation of telemedicine has on a community.

**Societal Level**

The third level of perspective is that of society. A society is a relatively autonomous population whose members share a cultural identity and way of life, interact in patterned

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ways, and reside in a common geographic territory.\textsuperscript{20} This perspective is the broadest, encompassing such factors as income and health distributions. Once again, the whole is not merely the sum of its parts. Societal benefits and costs extend beyond both the individuals within a community and the communities themselves. For example, a social benefit is enjoyed when all individuals in society are inoculated against the flu. Individuals remain healthy and communities remain productive. Likewise, a social cost is incurred when individuals attempt to be free riders by not receiving an inoculation – assuming that everyone else did. Why should they spend the money, since they will not be exposed to sick individuals? Too many individuals thinking in this manner can result in an outbreak, leaving the individuals at even greater risk of exposure. Furthermore, if an outbreak occurs, community production rates fall, as more individuals have to miss work due to illness. This illustration serves to exemplify further the influence of societal factors on both individuals and communities.

A key distinction between community and society is that society includes numerous communities. Thus, as interaction takes place between and among communities, society can either gain or lose. If one community is able to improve its health status, or reduce the crime rate, other communities are impacted. An infected individual from one community may transmit a disease or infection to another community. Production facilities may decide to locate in one community as opposed to another, due to crime rates, technological innovation availability, etc.

**Focus of Analysis**

\textsuperscript{20} Kindig DA (1997).
The second dimension of analysis is concerned about the focus of the analysis. When health care is discussed in the popular press, there are generally one or more of three major themes being addressed. These consist of: cost, quality, and access. Each is considered to be extremely important in its own right, and each plays a role in the political and economic discussion regarding the future of health care. Indeed, the primary factor driving reform has been difficult to discern, depending on the political activities taking place.

Cost

The cost of health care takes a larger proportion of Gross Domestic Product in the United States than in any other industrialized country, at 13.7 percent.\(^{21}\) The rate of increase has slowed over the past few years, but is still somewhat greater than economic growth. As long as this continues, the proportion of GDP accruing to health care will increase. While there is no evidence that the U.S. is necessarily spending too much on health care, there is a concern or belief that the United States does not receive sufficient value for the dollars being spent on health care services. It also appears that there is no consensus among the population about the amount that should be spent on health care.\(^{22}\) This is the societal view discussed in the first dimension of the analysis.

Cost is also important at the community and individual levels. Daily newspaper reports abound in regards to the cost of this procedure or that, and of the increasing impact of prescription drugs on health care costs.\(^{23}\) At the local level, hospitals complain

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that cost containment efforts are making it impossible to keep their doors open, especially those located in rural regions of the country.\textsuperscript{24} Physicians bristle at the idea that cost should be considered when making medical decisions.\textsuperscript{25}

Regardless of the social issues involving the extent to which economics should play a role in medical decision making, it is obvious that costs will play a role in the future development of health care.\textsuperscript{26} Evaluation of telemedicine, as well as other health-related innovations, will have to include an economic (benefit and cost) aspect in the future.

\textbf{Quality}

The quality issue is receiving a great deal of research funding at the present time. Outcomes research, and evidence-based medicine, are the current buzzwords for research and grant applications, and will become increasingly important to the innovation and research activities.\textsuperscript{27,28} While, currently, managed care is focused on cost reductions, ultimately, managed care was originally designed to improve the health status of the population, especially through an improvement in the quality of health services delivered. Perhaps one day this focus will return.

\begin{flushright}
\begin{footnotesize}


\textsuperscript{27} Balas EA, S Austin Boren, LL Hicks, et al (1998). “Effects of Linking Practice Data to Published Evidence: A Randomized Controlled Trial of Clinical Direct Reports.” \textit{Medical Care} 36: 79-82.

\end{footnotesize}
\end{flushright}
As the public receives more information from public reporting of hospital, physician, and health plan utilization and outcomes, quality will play an increasingly important role in health decision making. Employees will demand that employers contract with high quality providers. Employers and health plans will make increasing use of centers of excellence, as research is indicating that longer-term costs are reduced by focusing services on high volume providers. The quality issue is very closely related to cost, encouraging the use of benefit-cost or cost-effectiveness analyses. This appears to be especially relevant in the current discussion of the use of brand name drugs relative to generic labels. Effectiveness of the drug relative to the cost should be an important determinant of its use.

Access

The issue of access played a primary role in the ill-fated Clinton Health Plan. Statistics, such as the 40 plus million uninsured Americans, provided the backdrop for plans to provide universal health insurance. A search of the literature found little in the way of discussion regarding the access issue. Anecdotal evidence would lead one to the conclusion that there are access issues in rural areas and inner cities, while the uninsured issue receives very little press. This could mean that there is insufficient consensus that there is an access problem. It may be believed that everyone has access to needed health services, through the emergency room of a local hospital, at the very least. There

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has been no strong linkage created between this form of access, and the cost of health care and the quality of that care, at least publicly.

While much of the access debate has revolved around the uninsured and underinsured at the national level, this is also a major issue at the local level. Rural hospitals are experiencing declining occupancy and reduced reimbursement for those patients being served. Individuals residing in rural areas may or may not have access to a readily accessible hospital or emergency room, or even a primary care physician. To the extent that society wishes to support a lifestyle, or reduce urban population, activities to encourage or support that lifestyle should be considered. This is a social issue, which should be addressed explicitly. Telemedicine has the ability to provide some of the advantages of an urban community, such as access to specialist physicians and educational opportunities, while preserving some of the advantages of rural living, such as lower population density, and rural activities such as farming and other agricultural activities.

In summary, any changes to the system, any innovations, any clinical developments, any new drugs, must all be evaluated in terms of their impact on these three areas. Increasing health care costs, both in real terms, and as a proportion of the national budget, has resulted in a major push to reduce health care costs. Likewise, there is an increasing emphasis being placed on the efficacy of medical treatments and

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the quality of services provided. This has led to increasing reliance being placed on the outcomes and quality implications of health-related activities. Finally, the last area to be considered, usually ranked below the first two in terms of impact on policy and relevance, is access. Access to health services is still important, related to both uninsured and underinsured, and access to health services is also important to individuals residing in remote and isolated areas of the country—including most rural areas.

The cost, quality, and access activities are important to the three levels of analysis: individual, community, and societal. Any evaluation must be explicit about the specific level addressed.

**Activities of Analysis**

The third dimension of any evaluation study is an exploration of the activities supported by the telecommunication resources. Once the technology and equipment are in place, telecommunication activities can take place for a variety of reasons—clinical, education, or administrative.

**Clinical**

The most highly visible (and possibly the most valued) uses of telemedicine resources are for clinical examinations, consultations, discussions, and other clinical purposes involving improvement in the diagnosis, treatment, and other decision making.

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relative to a specific patient. Telemedicine technology, at least in its present form, has been found to be used more often in some specialties than others. The broadest uses of the video and audio telemedicine interactions so far are in the areas of radiology, psychiatry, and dermatology, with cardiology and other areas following.

Psychiatry has been found to be a viable use, due to the interpersonal relationships involved, without the need for a physical examination to take place. On the other hand, dermatological cameras, under the hand of a skillful assistant, have been found to provide sufficient resolution on the receiving end for the physician to make confident diagnoses.

Experience at the University of Missouri has also found acceptance among cardiologists for the use of telemedicine for follow-up visits. The numbers of follow-up visits have been increasing, improving patient compliance, and both patient and physician comfort level with the encounter.

There is a great deal of flexibility in the use of telemedicine resources, where tactile examination is not needed. Otoscopes, stethoscopes, and other examination equipment have been specially designed for use with telemedicine equipment, and have been found to be at least as good as, and in some cases better than, those used in face-to-face

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encounters. For instance, otoscope views can be examined on a 27-inch TV monitor, providing a much better view, with excellent resolution.44

As the technology improves, there will be a broadening of the potential clinical applications of telemedicine. There are already experimental demonstrations of the performance of surgery over a distance. Likewise, virtual reality holds the potential for three-dimensional examination, along with tactile and even internal examinations to be performed.45

**Education**

There are other, non-clinical, uses of the resources that also enhance its value. For instance, the same telecommunications resources used for clinical encounters can be used for training professionals and other (provider and patient) educational purposes. Educational uses of the equipment can enhance its value, and have some of the same benefits in terms of reduced travel time and other value to the community. There are a variety of education functions that can be enhanced. Continuing medical education (CME) credits can be provided to a widely distributed audience from a central site. Resident training can be provided from a teaching facility to residents located in rural areas. Telecommunications equipment can be placed on rolling tables, allowing for exceptional mobility. The technology is easily connected to large screens, making it easily accessible to large groups of individuals. This permits the use of the technology to reach larger bodies, and is especially amenable to a classroom setting. The content can then be in the form of didactic materials, or actual case studies, or even for transmission of an actual

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patient encounter (with appropriate permission and approval, of course). The important point here is that there is a great deal of flexibility—in terms of where the technology can be used, the number of individuals involved, and the form of the education taking place.

**Administrative**

The third use of the telemedicine equipment is for the performance of administrative functions. Virtual meetings can be held among geographically dispersed individuals, enhancing the timeliness of and attendance at such meetings, and reducing the amount of time and money spent on travel. This is particularly true in today’s environment of multi-organizational systems, and the expanding network requirements of managed care. Dispersed participants can meet more often, share more democratically in the decision making, and therefore, bring value to the organization through greater input.

For example, meetings can be set up between two individuals, or among large groups of individuals. The number of individuals involved at any one site is constrained only by the size of the room. The same equipment used for teaching can be used for meetings. For instance, most telemedicine setups include an easy mechanism to transmit slides or transparencies, or even the printed page. This function is valuable, whether the application is clinical, educational, or administrative. Portability of the telecommunication equipment will only be enhanced in the future, making it easier to shift from clinical to education to administrative use of the equipment. Price will also be reduced, making it easier to have more than one set of equipment.

**Policy and Regulation**

One area that is not addressed explicitly in the model is the issue of policy and regulation. It is addressed implicitly, however, since policy and regulatory issues pervade many of the dimensions of the model. To a large extent, the success or failure of
telemedicine will be determined by the extent to which policies and regulations impede or permit activities, including reimbursement, licensing, and other legal issues.\textsuperscript{46}

**Evaluation Studies**

The three different dimensions on which evaluation studies are performed (level of analysis, focus of analysis, activities of analysis) are demonstrated graphically in Figure 1. The top of the cube represents a variety of stakeholders, or the level of analysis. The front of the cube represents the driving forces of health care, or the focus of analysis. The end of the cube represents the different uses of telemedicine, or the activities of analysis. All evaluation studies examine at least one of the cells indicated. It is more likely, however, that multiple cells are involved in any given evaluation study. For instance, clinical studies may use an individual or community approach, while examining both cost and quality issues. It is necessary, however, for all comprehensive studies to utilize all three dimensions, either explicitly or implicitly.

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While the level of analysis provided in Figure 1 provides a representation of the different broad categories, there are a number of subdivisions that any study might want to use. For example, the focus of the individual level of analysis might be the individual patient, the individual primary care physician, the individual specialist, the individual clinic, the individual nurse, or a variety of other individuals. These further subdivisions are presented in Figure 2, where the broad category of Individuals is divided into four individual sub-categories. While this sub-classification scheme may not be comprehensive, it provides sufficient divisions to assist in the evaluation of the Missouri Rural Telemedicine Evaluation Project/Rural Telemedicine Grant Program (RTEP/RTGP).

As a part of the research project at the University of Missouri, a working definition of telemedicine had to be developed. For purposes of this project, the evaluation team accepted the broad definition from the Institute of Medicine, in which telemedicine is defined as: “The use of electronic information and communications technologies to
provide and support health care when distance separates the participants."47 Using this
definition, a comprehensive literature review was performed, examining evaluation
methodologies and specific applications to telemedicine. A total of 833 publications were
examined and categorized according to type of study, methodologies used, etc. The
complete annotated bibliography was included in the final project report, and has been
reported elsewhere.48 Of primary importance to the current paper is the fact that very little
literature has been published on the development of a systematic evaluation methodology
for telemedicine. The majority of studies are very narrowly focused, so do not capture
many of the broad benefits provided by telemedicine. Unless studies are performed that
eventually identify and capture the majority of the benefits and costs associated with
telemedicine, there will never be sufficient data with which to make a rational decision.

Other Model Development

At least two simulation models have been created to evaluate the use of
telemedicine.49,50 Both of these are focused strictly on the clinical use of telemedicine
resources, and neither capture the social benefits associated with providing telemedicine
services to individuals located in rural areas.

47 Fields (1996). p. 1


50 Speedie SM, J Stensland (1999). "A Model for Evaluating the Cost Impact of Telemedicine as Compared to
Face-to-Face Care." http://www.peds.umn.edu/telemed/ataposter.html.
In addition, another study\textsuperscript{51} has suggested five specific questions to be considered in the performance of evaluation studies:

1. Are specific telemedicine applications medically effective means of delivering health care?
2. What are the costs involved in specific telemedicine applications and are these applications cost-effective means of providing health care?
3. What process of telemedicine care are associated with optimal health outcomes?
4. Can appropriate use be defined?
5. How should payment for telemedicine services be handled?

In concluding, Grigsby suggests that telemedicine need not be any more thoroughly evaluated than traditional medical care, but that it is important to understand how the processes, costs, and outcomes of the two modes of delivery compare.

There appear to be two problems with the above. First, the questions all deal with the clinical application of the telemedicine technology, and do not specify the focus of the question–from whose standpoint are the questions being asked? The answer will determine how the analysis proceeds. Telemedicine needs to be evaluated more than traditional medical care, if it is to be used, expanded, accepted, and its potential realized.

Traditional medical care provides for direct provider-patient interaction, and is only now being evaluated in terms of outcomes and evidence for use. Telemedicine, however, results in a change in the transaction among a variety of stakeholders, and will need to provide a guaranteed improvement in some aspect of the transaction before different stakeholders will be willing to support its use.

Huston and Smith\textsuperscript{52} took a more global view of health care, and suggested that telemedicine evaluation had to take place as only one part of an entire health delivery system. This is an important point, and more in line with the model presented in this report. DeChant et al,\textsuperscript{53} consistent with this global view, suggest that telemedicine evaluation might best proceed with a process similar to new drug evaluation. Products would be examined from safety to efficacy to effectiveness. This would be a very focused and valuable approach. However, it assumes that the infrastructure is already in place and being used sufficiently to provide the necessary data for evaluation. Perhaps, in the future, this evaluation may take place. At the present time, it is more important that the efficacy and efficiency of the technology be demonstrated sufficiently to support the continuing availability of the technology, so that the clinical and economic studies can proceed.

An additional study\textsuperscript{54} provides a list of six domains that should be evaluated for each telemedicine application:

1. Clinical outcomes
2. Technical acceptability
3. Health systems interface
4. Costs and benefits
5. Patient/provider acceptability
6. Access

This is an important list of domains, fitting within the comprehensive model. The specific area of the comprehensive model provided in these domains is the clinical application, examining cost, quality, and access, at the individual level. It is important to


recognize that specific evaluations of telemedicine and telecommunication utilization need to be specified more precisely than the general dimensions provided by the comprehensive model. The comprehensive model provides a framework within which the specifics of any evaluation study should be performed. It is extremely important to drill down within the model to the level of specificity needed by the particular evaluation study.

A recent monograph\textsuperscript{55} provides a somewhat unique approach to evaluation. The author correctly notes that “none of the programs provide suggestions on how to move from specific technology assessment to the assessment of telemedicine in the continuum of care.”\textsuperscript{56} This is important to the continuing development of managed care, and to the future existence of telemedicine. This monograph provides a framework to be used for a progression approach to evaluation: from technology and environment assessment, to clinical costs and integration, to measures of provider and patient satisfaction by considering the value and capacity of telemedicine technologies to complete basic clinical tasks. “The insertion of the intermediate step of clinical task assessment could provide the missing link in the ability to generalize from a few tasks to the broader range of clinical practices.”\textsuperscript{57} This model, while providing a novel and interesting approach, again uses only the clinical activity for the use of the technology. Thus, it is at a different level of analysis. It is not as comprehensive as the current model, does not consider the different uses of the telemedicine equipment, and considers only one perspective. So far, the authors have not seen any other evaluation model discussion that provides a comprehensive tool within which every evaluation can be performed.

\textsuperscript{55} Yawn B (1999)
\textsuperscript{56} Ibid, p.8.
\textsuperscript{57} Ibid, p. 8
Conclusions

A variety of evaluation models have been developed. As was seen in the discussion of these models, there is a great deal of variability in the approaches taken by these models. It cannot be said that any model is correct and others are not, since each is unique, and deals with a different aspect of telemedicine. What should be obvious, however, is that these models deal with different levels, focus, and activities of the analysis. Most are specific to clinical uses, usually a specific clinical specialty or even procedure. The model developed for this specific research project, by the RTEP/RTGP team, is the most comprehensive of the evaluation models. Other models are subsets of this model. This comprehensive model can, and should, be used in developing further telemedicine evaluation research. While future research does not have to be comprehensive, each study should explicitly indicate the level, focus, and activities of analysis included.
EVALUATING TELEMEDICINE:
DO PATIENT CHARACTERISTICS COUNT?
A DERMATOLOGY CASE STUDY

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Telecommunications and advanced information technologies have increasingly been used for clinical activities, education, administration, and research to improve health care delivery. Telemedicine is a term used to describe technologies involved in providing and supporting health care when participants are separated by distance. Telemedicine is designed to improve access to health services for individuals living in remote and isolated regions of the country, to assist in the speed with which health services can be provided to these individuals, and to provide access to health professionals with higher skill levels and greater expertise. Since its first use by NASA during the 1960s,\(^1\) telemedicine’s use in the United States has increased to an estimated clinical usage of 250,000 diagnostic teleradiology studies and 46,200 interactive video and store-and-forward teleconsultations in 1997.\(^2\) In addition to medical efficacy issues, attention is also focusing on understanding factors related to decisions to use these distance visits rather than face-to-face visits. This study examines the extent to which patient characteristics are associated with the use of telemedicine in a single medical specialty—dermatology.

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Background

Numerous studies\(^3\,4\,5\,6\,7\) have found teledermatology, or practicing dermatology via telemedicine, to be as effective as a traditional face-to-face visit in diagnosing conditions in 75 to 85 percent of cases. There are still certain conditions for which telemedicine is not adequate or appropriate; this 15 to 25 percent of cases need traditional direct interactions. Previous studies indicate that, clinically, teledermatology is a feasible alternative in many cases, where circumstances, such as geography, do not allow for convenient face-to-face consultation with a dermatologist.

In addition to clinical efficacy, patient and provider satisfaction and acceptance are critical. Studies\(^8\,9\,10\) have shown that the majority of teledermatology patients were very pleased with the services, with satisfaction levels ranging from 75 to 100 percent. In a survey conducted in 1997,\(^11\) all participants strongly agreed with the statement: “This


\(^8\) Kvedar JC (1997).


\(^10\) Dick PT (1999).

technology is of value to you and your community.” Furthermore, research\textsuperscript{12} examining nursing home residents found that 80 percent of residents preferred to receive all of their specialty care via telemedicine, while 83 percent specifically preferred teledermatology to traveling to their dermatologist’s office. As these studies indicate, patients not only find telemedicine an acceptable alternative to face-to-face consultations, but also, in certain cases, tend to prefer teleconsultation to traditional visits.

Previous research has also examined the level of acceptance of, and satisfaction with, telemedicine by physicians. A majority of the physicians surveyed, who have participated in teledermatology, reported teledermatology to be valuable to patients with limited access to dermatology services.\textsuperscript{13,14} No significant differences in physician satisfaction rates or confidence levels could be found when comparing face-to-face dermatology consultations to those done via teleconsultation.\textsuperscript{15} Other studies\textsuperscript{16,17,18} have shown that, especially during initial use of telemedicine, dermatology consultants had less confidence in their diagnosis compared to in-person diagnosis. These studies, however, could find no significant differences in prescribed treatments or outcomes based on this lack of confidence. In addition, it is expected that confidence levels will increase as telemedicine training is implemented more widely, and as more health professionals gain experience in utilizing telemedicine equipment.

\textsuperscript{12} Zelickson BD (1997).
\textsuperscript{13} Gilmore E (1998).
\textsuperscript{14} Reid DS (1998).
\textsuperscript{15} Lowitt MH (1998).
\textsuperscript{16} Kvedar JC (1997).
\textsuperscript{17} Phillips CM (1997).
In addition to the technological practicality and patient/provider acceptance, teledermatology has also been shown to be a cost-effective alternative to traditional visits. Research\textsuperscript{19,20} focused on the use of telemedicine in prison systems has reported savings between $8 and $14 per consultation. Furthermore, it has been shown\textsuperscript{21} that rural dermatology patients spent 52 percent less for care when diagnosed via telemedicine compared to traditional visits. Other non-monetary benefits, such as increased access to care, reduced time in obtaining care, and reductions in travel requirements further substantiate the use of telemedicine as a viable alternative to many face-to-face consultations.

**The Setting**

The activities reported here were performed as part of larger projects, the Rural Telemedicine Evaluation Project (RTEP) and the Rural Telemedicine Grant Program (RTGP), and utilize data collected from ten Missouri Telemedicine Network (MTN) sites. Each of these ten sites has a dermatology outreach clinic within the county. Thus, the physician, at least theoretically, had three different sites at which to see each patient – the hub clinic, the outreach clinic, or via telemedicine. The first two options involve travel by either the patient or the physician, while the third option involves the least amount of travel for both parties. The approach taken in this analysis is a case study of all patients seen by a single dermatologist associated with the telemedicine hub facility during the period

\textsuperscript{18} Gilmore E (1998).

1/1/97 – 3/31/99. In doing statistical tests on these data, this group of patients was treated as a sample from the population who might have been seen by this dermatologist. The purpose was to examine the extent to which patient characteristics played a role in the use of teledermatology services as a substitute for face-to-face visits. To avoid potential confounding impacts from physician characteristics, the study was limited to patients of a single dermatologist.

**Research Questions**

Several hypotheses were tested and assumptions explored during this study. Hypothesis 1 was that telemedicine would increase the demand for dermatological (and other) health services, due to improved convenience for the patient and increased ease of referral from the remote site. Hypothesis 2 was that the use of telemedicine is more acceptable to younger individuals, based on an assumption that younger individuals have had greater exposure to computers, video games, and technologies, resulting in greater acceptance of new technologies and less difficulty interacting with the physician via television. Hypothesis 3 was that the use of telemedicine would be greater for males, given the higher work force participation rate of males that creates a higher relative value of time for the employed individual. Hypothesis 4 was that source of payment would have an impact on the use of teledermatology services, based on the assumption that source of payment is highly correlated with other characteristics of the population and the health care system that would influence the use of telemedicine. Hypothesis 5 was that the broad clinical diagnosis of the patient would be related to the use of teledermatology services.

services, with certain diagnoses being less appropriate for diagnosis and treatment via telemedicine than others. The next two issues are presented and explored as assumptions or conjectures rather than hypotheses, because the data do not all statistical testing. Assumption 6 was that patients would be highly satisfied with the services received through teledermatology, reflecting increased convenience and lower costs associated with using health care. Assumption 7 was that access to dermatology services would be improved with telemedicine, and, as a result, quality of health care would increase.

The Data

To answer the research questions, data were collected from two major sources. The first set of data was abstracted from the computerized patient record database of the participating dermatologist at the hub facility. Elements extracted from the administrative database for all patients seen by the dermatologist (regardless of use of telemedicine) during this process were: age, gender, number of visits, source of payment, county of residence, and major diagnosis. This permitted an examination of the visits via telemedicine relative to other visits by the telemedicine cohort, provided in a face-to-face visit, and an examination of those individuals who did not have a telemedicine visit. These data were used to answer research questions 1, 2, 3, 4, and 5.

The second set of data was obtained from a questionnaire completed at each visit by patients using telemedicine services in the Missouri Telemedicine Network. Elements obtained from this data set, keyed to select only and all patients seen by the participating dermatologist, included: employment status, distance to the telemedicine site, distance to the hub site, patient satisfaction, and access to services in the absence of telemedicine.
These data enabled the examination of the utilization of dermatological services in terms of patient demographics, employment status, distance, and patient satisfaction. The data were collected for the period 1/1/97 – 3/31/99. These data were used to explore research questions 6 and 7.

In the following discussion, the population analyzed is segmented in different ways. The different sub-populations presented are: 1) all patients, referring to all dermatology patients of the specific physician during the study period; 2) telemedicine patients, referring to patients who had at least one telemedicine visit; and 3) non-telemedicine patients, referring to the dermatologist’s patients who did not have a telemedicine visit during the study period. In the analysis, outreach and non-outreach counties will also be presented, where outreach counties refer to those counties within which telemedicine equipment and capabilities exist.

Results

Administrative Database

Patient record data were abstracted from an administrative database for the 1,365 patients seen by the dermatologist between 1/1/97 and 3/31/99. These patients accounted for 2,582 visits during this period, an average of 1.9 visits per person, with a range of 1 to 78 visits. Of the patients, 906 (66.4%) had only one visit to the dermatologist. Of those patients with multiple visits, 226 (49.2%) had two visits, 106 (23.1%) had three visits, and 127 (27.7%) had four or more visits. The patients with multiple visits (459) averaged 3.7 visits per person and accounted for 64.9 percent of all visits.
Of the 1,365 patients seen by the dermatologist, only 277 (20.3%) resided in the ten counties in which telemedicine services were available. Of the 277 patients, 118 (42.6%) were seen via telemedicine by the dermatologist; in addition, 14 patients from non-outreach counties (1.3%) were seen via telemedicine. As indicated, 132 patients (9.7%) received teledermatology services during the study period. These 132 patients had 201 visits, or an average of 1.5 visits per person.

**H₁: Telemedicine will increase the demand for dermatological services.**

The rationale behind this hypothesis was that access to dermatology services would be more convenient for the patient, since the patient could avoid the extended travel time and costs necessary to visit the dermatologist in the hub facility. Also, it was believed that it would be easier for the local providers to refer the patient for dermatology services if the services were provided locally through telemedicine. Because of the reduction in travel time and costs, and the increased ease of making referrals, it was expected that the demand for dermatology services would increase over time. The data tend to support this expectation (see Table 1), especially given the decline in overall dermatology visits during the time period of the study. Of all dermatology visits, for which location of patient is known, the proportion from outreach counties in each timeframe (1997, 1998, and Q1 of 1999) increased from 11.5% to 24.9% to 32.0%. The changes are statistically significant (Cochran-Armitage test for trend, p < .0001).

<table>
<thead>
<tr>
<th>TABLE 1: TOTAL NUMBER OF DERMATOLOGY VISITS BY YEAR AND LOCATION</th>
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<tr>
<td>PROXIMITY TO TELE-DERMATOLOGY</td>
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<tr>
<td>Non-outreach</td>
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<tr>
<td>Outreach</td>
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<td>Missing</td>
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<td>Total</td>
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In 1997, there were a total of 1,222 visits provided. This number declined to 1102 in 1998, and is annualized to continue declining to 1,032 in 1999. This trend is reversed, however, in the outreach counties in which teledermatology services were available. In 1997, there were 137 visits provided to patients in the outreach counties. In 1998, that number had increased 96.3%, to 269. Extrapolating first quarter 1999 data to a full year, then the number of visits is expected to increase another 20.4%, to 324 visits. The increase in visits in the outreach counties is not sufficient to overcome the overall decrease in the utilization of dermatology services. The data in the outreach counties do tend to support the hypothesis that telemedicine will lead to an increase in the use of services as travel time and costs decline and ease of referral increases. These cases were not all seen via telemedicine. Other factors may account for these changes.

**H₂: Younger individuals will be more likely to use telemedicine services**

This hypothesis was based on the assumption that younger individuals would be more comfortable interacting with a physician via telemedicine because of their greater exposure to computers, interactive video games, and telecommunication technologies. It was assumed that this greater exposure to technologies would increase the level of acceptance and use of teledermatology. The data do not support this hypothesis (see Table 2). The mean age of all patients was 42.2 years.

<table>
<thead>
<tr>
<th>TABLE 2: UTILIZATION OF TELEDERMATOLOGY BY AGE, PROXIMITY TO TELEDERMATOLOGY SERVICES, AND FREQUENCY OF VISITS</th>
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<td>Non-outreach, multiple visits</td>
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<td>Non-outreach, total visits</td>
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</tbody>
</table>

In analyzing the age of patients, the effect of primary interest was whether or not there was a difference between those patients that used teledermatology services and those that did not. In order to test for the differences in mean ages for patients using or not using teledermatology services, analysis of variance was used. To control for factors of proximity (patient from an outreach county or not) and frequency of visits (single visit or multiple visits), a 3-way ANOVA was used. Using SAS General Linear Models Procedure, the p-value for the teledermatology services main effect was 0.9285, indicating no significant differences in the mean ages of the teledermatology patients and those patients seeing the dermatologists for face-to-face visits. As the following p-values indicate, there were no significant interactions with any of the controlling factors analyzed: proximity to teledermatology, p-value = 0.8388; frequency of visits, p-value = 0.2932; and proximity * frequency, p-value = 0.4037. Consequently, it is concluded that the age of individuals using teledermatology is not significantly different from the age of individuals who use face-to-face visits to dermatologists.

**H₃: Males 22-64 use teledermatology to a greater extent than females 22-64**

The rationale for this hypothesis is the relationship between gender and participation in the work force, with the expectation that individuals who were employed would place a higher value on activities that decreased their need to be absent from work. Given the assumption about work force, the analysis was limited to working-age
individuals, defined here as individuals between the ages of 22 and 64. Given the higher labor force participation rate of males, it was, therefore, assumed that males would be more likely to use teledermatology services than females (see Table 3). The data do not support this hypothesis, however.

| TABLE 3: NUMBER OF DERMATOLOGY PATIENTS 22 - 64 BY GENDER, FREQUENCY OF VISITS, AND PROXIMITY TO TELEDERMATOLOGY SERVICES |
| PROXIMITY TO TELEDERMATOLOGY | NON-TELEMEDICINE PATIENT | TELEMEDICINE PATIENT | ALL PATIENTS |
|                             | FEMALE | MALE  | FEMALE | MALE |
| Non-outreach, single visit  | 252    | 177   | 3      | 1    | 433 |
| Non-outreach, multiple visit| 129    | 90    | 1      | 0    | 220 |
| Outreach, single visit      | 32     | 28    | 21     | 10   | 91  |
| Outreach, multiple visit    | 24     | 6     | 11     | 9    | 50  |
| All Visits                  | 437    | 301   | 36     | 20   | 794 |

In the study, there were 437 females (55.0%) and 301 males between the ages of 22 and 64. Among the teledermatology patients in this age cohort, there were 36 females (64.3%) and 20 males. In the outreach counties, the distribution was 88 females (62.4%) and 53 males. Using the Cochran-Mantel-Haenszel Statistic, controlling for frequency of visit and proximity to teledermatology services, no significant difference was found in the gender of the teledermatology patients compared to the patients using face-to-face visits (p-value = 0.736).

**H₄: Source of payment impacts use of teledermatology services**

Under the current Medicare payment regulations, providers must have some face-to-face contact with a patient in order to be reimbursed.²² As a result, source of payment in this case refers to the primary type of insurance carried by the patient, and not to the

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actual source of payment received for the services rendered. The hypothesis is based on the assumption that the type of insurance the patient has reflects other characteristics of the patient (e.g., age) and of the health care system (e.g., availability of managed care in rural communities), and could have an impact on the individual’s decision to use teledermatology services. It was also assumed that the number of times an individual was seen could be related to the type of insurance the individual had. As a result, the patients were allocated into three categories: those with only a single visit; those having two or three visits; and those having four or more visits.

When all patients in the study are analyzed, the data tend to support this hypothesis, although the evidence is weak—Cochran-Mantel-Haenszel General Association p-value = 0.031 (see Table 4). However, when only those patients in the outreach counties are analyzed, the source of payment was not significantly different between the teledermatology patients and the patients using face-to-face visits—Cochran-Mantel-Haenszel General Association p-value = 0.719 (see Table 5).

<table>
<thead>
<tr>
<th>TABLE 4: SOURCE OF PAYMENT BY TYPE OF PATIENT AND FREQUENCY OF VISITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>TYPE OF PATIENT</td>
</tr>
<tr>
<td>Non-telemedicine, single visit</td>
</tr>
<tr>
<td>Non-telemedicine, 2 – 3 visits</td>
</tr>
<tr>
<td>Non-telemedicine, 4 or more visits</td>
</tr>
<tr>
<td>All Non-telemedicine</td>
</tr>
<tr>
<td>Telemedicine, single visit</td>
</tr>
<tr>
<td>Telemedicine, 2 – 3 visits</td>
</tr>
<tr>
<td>Telemedicine, 4 or more visits</td>
</tr>
<tr>
<td>All Telemedicine</td>
</tr>
<tr>
<td>All visits</td>
</tr>
</tbody>
</table>
The information in Table 5 tends to support the hypothesis that source of payment impacts the use of telemedicine services. However, as discussed earlier, source of payment is a proxy for other characteristics influencing the use of telemedicine. As a result, it might be more accurate to interpret these results as an indication that the characteristics of the population and the features of the health care system are different in the outreach counties than in the other counties in the study. For example, the counties in which teledermatology services are offered are inherently rural counties, and in Missouri, rural counties tend to have an older population (greater Medicare) and managed care has not penetrated widely into the more remote rural counties of Missouri. These interpretations gain credence when the data in Table 5 are analyzed.

<table>
<thead>
<tr>
<th>TYPE OF PATIENT</th>
<th>MEDICARE</th>
<th>MEDICAID</th>
<th>COMMERCIAL</th>
<th>HMO</th>
<th>OTHER</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-telemedicine, single visit</td>
<td>24</td>
<td>7</td>
<td>40</td>
<td>30</td>
<td>7</td>
<td>108</td>
</tr>
<tr>
<td>Non-telemedicine, 2 – 3 visits</td>
<td>11</td>
<td>2</td>
<td>10</td>
<td>5</td>
<td>2</td>
<td>30</td>
</tr>
<tr>
<td>Non-telemedicine, 4 or more visits</td>
<td>5</td>
<td>3</td>
<td>5</td>
<td>6</td>
<td>2</td>
<td>21</td>
</tr>
<tr>
<td>All Non-telemedicine</td>
<td>40</td>
<td>12</td>
<td>55</td>
<td>41</td>
<td>11</td>
<td>159</td>
</tr>
<tr>
<td>Telemedicine, single visit</td>
<td>24</td>
<td>8</td>
<td>28</td>
<td>21</td>
<td>2</td>
<td>83</td>
</tr>
<tr>
<td>Telemedicine, 2 – 3 visits</td>
<td>8</td>
<td>2</td>
<td>13</td>
<td>3</td>
<td>4</td>
<td>30</td>
</tr>
<tr>
<td>Telemedicine, 4 or more visits</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>5</td>
</tr>
<tr>
<td>All Telemedicine</td>
<td>33</td>
<td>12</td>
<td>42</td>
<td>25</td>
<td>6</td>
<td>118</td>
</tr>
<tr>
<td>All visits</td>
<td>73</td>
<td>24</td>
<td>97</td>
<td>66</td>
<td>17</td>
<td>277</td>
</tr>
</tbody>
</table>

The data in Table 5 reflect patients from outreach counties only. In these counties, differences in the source of payment for services are not significant between telemedicine and non-telemedicine patients. In these counties, the population characteristics and features of the health care system are homogeneous for both types of patients.
**H$_5$: Diagnoses of patients are related to use of teledermatology**

This hypothesis was based on the assumption that certain clinical conditions and illnesses are more suitable for diagnosis and treatment via telemedicine than others. It was assumed that the types of illnesses are similar across populations, and that differences in site of treatment (telemedicine vs face-to-face) reflect clinical situations. It was also assumed that the frequency of visits would be related to the type of illness. Consequently, the patients were allocated into three categories: those with only one visit, those with two or three visits, and those with four or more visits. In this analysis, only those counties in which teledermatology services were available were included: the outreach counties (see Table 6). The data support the hypothesis that diagnosis influences the use of teledermatology services.

<table>
<thead>
<tr>
<th>TYPE OF PATIENT</th>
<th>SINGLE VISIT</th>
<th>2 – 3 VISITS</th>
<th>4 OR MORE VISITS</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Viral</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Neoplastic</td>
<td>27</td>
<td>10</td>
<td>4</td>
<td>41</td>
</tr>
<tr>
<td>Circulatory</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Inflammatory</td>
<td>30</td>
<td>12</td>
<td>5</td>
<td>47</td>
</tr>
<tr>
<td>Other Skin</td>
<td>26</td>
<td>4</td>
<td>6</td>
<td>36</td>
</tr>
<tr>
<td>Other</td>
<td>23</td>
<td>2</td>
<td>4</td>
<td>29</td>
</tr>
<tr>
<td>Total</td>
<td>108</td>
<td>28</td>
<td>20</td>
<td>156</td>
</tr>
</tbody>
</table>

In analyzing the diagnosis of the patient, individual ICD-9 codes were aggregated into broader diagnostic categories, reflecting general health problems within the...
dermatology population. These broader groups were then used in determining the significance of the differences observed between the diagnoses of teledermatology patients and those patients using face-to-face visits. As indicated by the Cochran-Mantel-Haenszel General Association p-value of 0.006, there is a difference in the diagnosis of patients using teledermatology visits and patients using face-to-face visits.

Survey Database

In addition to the administrative patient record database, information was also obtained from questionnaires administered to patients using telemedicine services in the Missouri Telemedicine Network (MTN). A variable on the questionnaire enabled the responses analyzed to be limited only to the telemedicine patients of the dermatologist participating in the study. The questionnaires were distributed each time a telemedicine visit was made, so individuals may be included in the responses more than once. These survey responses are used to address hypotheses 6 and 7.

In the survey database, there were 321 patients who completed 483 surveys, although not all questions were answered on all surveys. Given the database, it is not possible to determine a response rate, since the number of surveys actually distributed is not known. The mean age of the patients in this survey database was 46.5 years, compared to 42.2 in the administrative database. In addition, 60.0 percent of the patients in this database were females, compared to 56.0 percent in the administrative database. Of the 321 patients responding to the survey, 266 (77.1%) had only a single visit, compared to 66.4% in the administrative database. Only 49 patients completed two questionnaires, with 30 completing three or more questionnaires. The highest number of questionnaires completed by one individual was eight. When all survey responses are
used (including multiple visit data), the mean age was 47.9 and 60.1 percent were female.
In the following analysis, the emphasis is on patient satisfaction with a telemedicine visit, so each visit is important in reaching an understanding of factors associated with satisfaction, since an individual’s satisfaction may vary by visit. Consequently, the following analysis is based upon all responses to the surveys, not just unique patients.

A6: Teledermatology patients are highly satisfied with their care

Based upon other reported results regarding levels of satisfaction with telemedicine services, it was expected that individuals using teledermatology services in the Missouri Telemedicine Network (MTN) would be highly satisfied with the care received via telemedicine. On the survey, eight questions were asked regarding satisfaction with the telemedicine experience (see Table 7). These questions asked for responses on 7-point Likert scales, with higher numbers reflecting more positive responses to the questions.

<table>
<thead>
<tr>
<th>QUESTION</th>
<th>- LIKERT SCALE</th>
<th>+</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1 2 3 4 5 6 7</td>
<td>6&amp;7</td>
<td></td>
</tr>
<tr>
<td>NUMBER OF RESPONDENTS</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overall, how satisfied were you with today's telemedicine session? (n=258) (1 = very unsatisfied, 7 = very satisfied)</td>
<td>5</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>How easy was it to talk with the telemedicine provider? (n=257) (1 = very difficult, 7 = very easy)</td>
<td>2</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>How much did the telemedicine provider seem to care about you as a person? (n=254) (1 = very little, 7 = very much)</td>
<td>0</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Did you feel relaxed or tense during the telemedicine session? (n=258) (1 = very tense, 7 = very relaxed)</td>
<td>2</td>
<td>2</td>
<td>7</td>
</tr>
<tr>
<td>Do you think telemedicine improves your medical care? (n=244) (1 = not at all, 7 = very much)</td>
<td>1</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Do you think your telemedicine session was as good as a regular in-person visit? (n=255) (1 = not as good, 7 = much better)</td>
<td>3</td>
<td>4</td>
<td>9</td>
</tr>
<tr>
<td>How well did the telemedicine equipment</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
As the data in Table 7 indicate, there is a high level of satisfaction among MTN patients using teledermatology services. In response to the question regarding overall satisfaction with the telemedicine session, 88.0% of the respondents answered in the top two positive categories, indicating they were very satisfied. In addition, when asked if the telemedicine visit was as good as a regular in-person visit, the scale went from *not as good* (2.7%) to *much better* (69.4%). Written comments provided on the open-ended question portion of the survey helped to explain some of this feeling. In these comments, several telemedicine patients explained that they felt they had the physician’s undivided attention during the visit, whereas the same focus does not appear to be present in the face-to-face visit. In terms of all questions, 83.8% of the responses were in the top two categories on the 7-point Likert scale, where the upper range of the scale on all questions was associated with a positive result.

The responses to the eight satisfaction questions were also analyzed by basic demographic characteristics (age and gender) of the population (see Table 8). The top two categories reflect a more positive response to the question than do the lower categories of responses.

<table>
<thead>
<tr>
<th>TABLE 8: PERCENT OF RESPONDENTS INDICATING TOP TWO CATEGORIES ON 7-POINT LIKERT SCALE BY AGE AND GENDER</th>
</tr>
</thead>
<tbody>
<tr>
<td>SATISFACTION QUESTIONS</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Q1 – General Satisfaction</td>
</tr>
<tr>
<td>Q2 – Ease of Communicating</td>
</tr>
<tr>
<td>Q3 – Caring</td>
</tr>
<tr>
<td>Q4 – Amount of Tension</td>
</tr>
</tbody>
</table>
When gender of the respondents is considered, very small, insignificant differences were observed in the responses. Except for the question comparing the telemedicine session to an in-person visit, a higher percent of males tended to rate telemedicine more satisfactory than did females, although the rates were very high in both instances. When age cohorts were considered, a smaller percent of the younger population was highly satisfied with telemedicine, compared to the older cohorts.

A7: Access to dermatology services is improved with telemedicine

It was expected that access to health care services would be improved with the availability of teledermatology services, and that this improved access would lead to increased utilization of health care services. It was then assumed that this increased access would lead to improvements in health care quality. While this latter assumption could not be empirically tested with the current data base, there is sufficient evidence\textsuperscript{23,24} regarding the linkage between access and quality to support the assumption in this hypothesis. The data from this survey do support the hypothesis that access to health care services is improved with the availability of telemedicine.

An important question asked on the survey was: “How would you have handled your health problem without telemedicine?” (see Table 9). Among the 256 respondents to this question, 67 (26.2%) indicated they would not have received health care at that time.


\textsuperscript{24} Andrulis DP (1998). “Access to Care Is the Centerpiece in the Elimination of Socioeconomic Disparities in Health.” 
point. Another 37 (14.5%) indicated they would have received health care services in their local community.

<table>
<thead>
<tr>
<th>TABLE 9: ACCESS TO CARE IN THE ABSENCE OF TELEMEDICINE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Response</td>
</tr>
<tr>
<td>Would not have gotten health care at this point</td>
</tr>
<tr>
<td>Would have gotten health care in my own community</td>
</tr>
<tr>
<td>Would have gone out of town for health care</td>
</tr>
<tr>
<td>Total respondents</td>
</tr>
</tbody>
</table>

For the 67 individuals indicating that they would not have received care at that point, it is reasonable to assume that the quality of health care, and possibly quality of life, would have been diminished in the absence of telemedicine. For the 37 individuals who would have received care in the local community, the consequences are not clear. These individuals had been referred to a specialist not available in the local community, but would have received care from the local providers rather than traveling to see a specialist. As a result, the lack of access to specialty care could have had a detrimental impact on the health of the individuals. For the 152 individuals who would have gone out of town to receive care, there are both clinical and economic consequences. Quality of care should not be compromised, since specialty services are received in both cases. However, utilization of care might be delayed, since the necessary services are less convenient when travel is required. When asked how far they would have had to travel one way for the specialty care, the average number of miles was 70.5 miles. If the IRS reimbursable rate of $0.31 per mile is used, then the average round-trip cost per patient is $43.71, and the total mileage costs for the 155 individuals making the trip to see the specialist is $673.13. In addition, if the trip to the specialist involved an employed individual, then additional time off from work would be required; if the individual required assistance from another individual, then that individual’s time was spent traveling to the
hub. Other costs and inconveniences associated with traveling between communities would also be incurred.

The responses to these three questions varied somewhat by gender. Males (n=28) were more likely to indicate that they would not receive health care (30.1% to 23.9%) than female (n=39); and males (n=15) were more likely to indicate they would receive health care in their own community (16.1% to 13.5%) than females (n=22). Females (n=102), on the other hand, were more likely than males (n=50) to seek care at an out-of-town site (62.6% to 53.8%).

An additional question asked the individual patients whether or not someone accompanied them to the clinic. This person is someone who provides services to the patient, such as companionship, transportation, or some other assistance. Among the 272 respondents to this question, 64 (23.5%) indicated they were accompanied by someone else for the dermatology visit. When responses to the three questions regarding how they would have accessed health care without telemedicine were examined relative to being accompanied, several differences were observed. Individuals accompanied by another person (n=21) were more likely to forego medical care than those unaccompanied (36.8% to 21.6%) by another person (n=42). On the other hand, those on their own (n=30) were more likely to seek care in their own community (15.8% to 10.5%) than those accompanied (n=6). Also, those unaccompanied (n=122) were more likely to seek care at an out-of-town site (61.4% to 52.6%) than those accompanied (n=30).

**Discussion**
Based on the data obtained from the administrative database, there does not appear to be any significant difference between the demographic (age and gender) characteristics of telemedicine patients and non-telemedicine patients in this case study of dermatology. Access to dermatology services appear to be improved in counties in which telemedicine services were provided, and increased utilization occurred among both patients using telemedicine and those using face-to-face visits in these outreach counties. In counties in which telemedicine was not available, visits to the dermatologist declined. It appears, from these data, that access to dermatology services is enhanced strictly through the availability of telemedicine services, even when a patient doesn’t use the service.

The extent to which these results can be generalized to other specialties is limited by the extent to which attributes of a face-to-face visit are impacted. This study, and a companion study in cardiology,25 generated the result that telemedicine visits are not an all or none proposition. For the same individual, telemedicine may be used only part of the time, with face-to-face visits also used. In this study, telemedicine was used for 42.6% of visits from individuals in the outreach counties. In the cardiology study, initial visits were always handled face-to-face and subsequent visits were alternated between telemedicine and face-to-face visits. The use of face-to-face visits with telemedicine patients provides an opportunity to minimize the transactional distance, and, possibly, enhance the physician-patient relationship.

Other specialties may require a greater amount of intermediate patient contact. On the other hand, others may require less, as in the case of psychiatric care.

Evaluation of telemedicine as a substitute for face-to-face visits requires a multi-faceted approach. This study has examined only one aspect of telemedicine. There were no apparent major obstacles to its use, and several favorable outcomes were observed. The elderly, and those less able to travel, indicated they would be more apt to forego health services, were it not for the availability of telemedicine. Additional research questions that need to be addressed are: How much does it cost to make telemedicine available to this population, and what is the value of convenience and quality of care associated with telemedicine. Future studies will need to address these issues.
EVALUATING TELEMEDICINE:

USING TELEMEDICINE TO AVOID TRANSFER OF
RURAL EMERGENCY DEPARTMENT PATIENTS

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EVALUATING TELEMEDICINE: USING TELEMEDICINE TO AVOID TRANSFER OF RURAL EMERGENCY DEPARTMENT PATIENTS

In 1998, the health care industry contributed $1,146.8 billion, or 13.7 percent, to the Gross Domestic Product (GDP). Of this amount, hospitals accounted for $383.2 billion, or 33.4 percent.\(^1\) As the magnitude of this number indicates, hospitals have an important role in the economy. This is especially true in rural communities, where hospitals serve multiple roles. Not only are these facilities the source of medical care, but they also serve as key employers, substantial supporters of local business, and magnets for social agencies and other medical services (physicians, therapists, pharmacies, mental health providers, etc).\(^2,3\)

While rural hospitals are major contributors to local economies, many of these facilities are experiencing financial distress in today’s competitive and cost-reducing environment. In 1995, approximately sixteen percent of rural hospitals experienced negative total margins.\(^4\) Conditions have not improved since then, with more rural hospitals facing bankruptcy or searching for new partners,\(^5\) including local community members. Telemedicine is now being viewed as another potential mechanism for alleviating some of the financial distress of rural

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\(^2\) Hart LG, BA Amundson, RA Rosenbaltt (1990). *As There a Role for the Small Rural Hospital?* @Journal of Rural Health 6(2): 101-118.


hospitals. Telemedicine, which involves two-way, interactive video transmissions and specialized electronic diagnostic equipment, should permit individuals, who would otherwise travel to urban hospitals, to be treated and retained locally, with no reduction in the quality of care received by these individuals. This will benefit the patient, the hospital, and the rural community.

**Rural Characteristics**

The environment in which rural hospitals function possesses various characteristics contributing to the challenges experienced by these organizations. The population residing in rural areas have characteristics that exert additional pressures on local facilities: they are elderly; are geographically dispersed; are growing slowly, if at all; have lower incomes and correspondingly higher levels of poverty; have less commercial health insurance coverage; and


10 Bronstein J and M Morrisey (1990). *Determinants of Rural Travel Distance for Obstetrics Care.* @Medical Care 28(9): 853-865.


have poorer health status.\textsuperscript{15} Moreover, the rural economy has a greater reliance on service industries and small businesses for employment, has low rates of economic development, and has a limited tax base for public support.\textsuperscript{16} Availability of health care providers is scarce, and medical technology is less sophisticated in rural areas, often leading to declining physical facilities and impaired reputations of rural hospitals.\textsuperscript{17} Also, support services, such as transportation and social services, are often limited in these communities. Regulatory and reimbursement constraints may endanger the local health organizations, and public health resources are scarce.

In general, the health-related work force is relatively small and isolated, and difficulty in recruiting and retaining providers in rural settings is experienced.\textsuperscript{18} When local providers do not have the capacity to provide the necessary services, patients must travel to, or be transported to, distant providers. When patients are required to leave the local community for medical care, their financial resources also leave the community. In addition, when patients have to leave the local community for needed health care services, it further harms the reputation of the rural facility, and creates a connection between the patient and the distant site. This connection, and comfort level, makes it more likely that the patient will bypass the local hospital in favor of the more distant facility the next time health services are needed.


Compounding the complexities of the delivery of medical services in rural communities is the issue of trauma care. While many persons will be affected by a serious trauma incident (accident or illness) during their lifetime, the consequences for rural individuals are often more severe. Recovery from accidents, cardiac events, and other illnesses have all been found to include a time frame within which some impacts are preventable and reversible. The chances of survival after a traumatic event improve, if the victim has immediate access to appropriate diagnosis and treatment.

Individuals experiencing serious trauma in rural areas often experience delays in treatment due, first, to lack of capacity in rural areas to deal with serious trauma, and second, to the distance to an urban center with sufficient capacity to deal with the situation. The application of telemedicine technologies in regional trauma systems has the potential for increasing the diagnostic and treatment capabilities of rural facilities.

**Telemedicine Services**

Telemedicine is designed to improve access to health services to individuals in isolated regions of the country. Telemedicine has been defined as “the use of electronic information and communications technologies to provide and support health care where distance separates the participants.” This broad, general definition encompasses a wide range of activities, including real-time interactive audio and video clinical encounters, all

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having a common function of the transference of information. In addition, telemedicine offers the advantage of not necessarily requiring all participants in an encounter to be at the same place at the same time.

There are two implications associated with the use of telemedicine in rural areas. The first is that treatment can be started earlier, where specialist consultation is available via telemedicine, even when it is necessary for the patient to be transferred to an urban hospital. Second, cases might arise where it is not necessary for the patient to be transferred to the urban hospital to receive specialty services, permitting the individual to be treated locally, perhaps with ongoing consultation from specialists located elsewhere.

The use of telemedicine technologies in rural emergency departments has the potential to impact chances of survival in cases of rural trauma, by making care available more rapidly over a larger geographic area, and, it also has the potential for improving the financial health of rural hospitals. If the local hospital can appropriately treat the patient through telemedicine consultation, then the local facility will receive the reimbursement for that hospitalized patient, and expenditures (direct and induced) will accrue to the rural community. For these potential gains to be realized, however, all participants must recognize the costs and benefits associated with their involvement in telemedicine.

The purpose of this article is to assess the potential for avoiding the necessity to transfer patients and to provide a model for estimating the financial implications of using

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telemedicine to avoid certain transfers. The model is illustrated with its application to two rural Missouri hospitals and communities.

**The Data**

As part of the Missouri Telemedicine Network (MTN) and participants in the Rural Telemedicine Evaluation Project (RTEP)/Rural Telemedicine Grant Program (RTGP), two rural hospital emergency departments were selected to serve as prototypes for this study. In conjunction with the MTN project, two-way interactive video conferencing systems with specialized electronic equipment were installed in late 1996 and early 1997 in these two hospitals. Baseline data were collected, retrospectively, for all patients transferred from the emergency departments in these rural facilities during 1996. The particular hospitals involved in this study were selected because their distance from the tertiary hub (59.3 miles and 93.7 miles) made transferring patients costly and time consuming, thereby delaying the onset of treatment. Table 1 provides data on various characteristics of the two facilities studied. As the data indicate, the rural hospitals are small (26 and 34 staffed beds), services provided are basic (intensity index scores of 54.6 and 50.1), and expenses per discharge are similar ($8,203 and $8,284).

<table>
<thead>
<tr>
<th>Hospital Characteristic</th>
<th>Hospital A</th>
<th>Hospital B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Licensed beds</td>
<td>34</td>
<td>57</td>
</tr>
<tr>
<td>Staffed Beds</td>
<td>26</td>
<td>34</td>
</tr>
<tr>
<td>Occupied beds</td>
<td>15</td>
<td>10</td>
</tr>
<tr>
<td>Service Intensity Index</td>
<td>54.6</td>
<td>50.1</td>
</tr>
<tr>
<td>Patient Retention Rate in Community</td>
<td>27.4</td>
<td>41.1</td>
</tr>
<tr>
<td>Total Admissions</td>
<td>997</td>
<td>1,162</td>
</tr>
<tr>
<td>Total Emergency Department Visits</td>
<td>3,919</td>
<td>5,567</td>
</tr>
<tr>
<td>Number of Emergency Department Transfers</td>
<td>407</td>
<td>285</td>
</tr>
<tr>
<td>Percent Medicare Discharges</td>
<td>59.9</td>
<td>67.3</td>
</tr>
</tbody>
</table>

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Table 1: Characteristics of Rural Hospitals in Telemedicine Evaluation

<table>
<thead>
<tr>
<th>Hospital Characteristic</th>
<th>Hospital A</th>
<th>Hospital B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percent Medicare Days</td>
<td>60.4</td>
<td>71.8</td>
</tr>
<tr>
<td>Expenses per Discharge</td>
<td>$8,203</td>
<td>$8,284</td>
</tr>
<tr>
<td>Case Mix Index</td>
<td>1.0769</td>
<td>1.0365</td>
</tr>
<tr>
<td>Average Length of Stay</td>
<td>5.40</td>
<td>3.25</td>
</tr>
<tr>
<td>Number of Inpatient Days</td>
<td>5,480</td>
<td>3,776</td>
</tr>
<tr>
<td>Total Expenses</td>
<td>$8,120,800</td>
<td>$9,692,423</td>
</tr>
<tr>
<td>Hourly Wage</td>
<td>$14.32</td>
<td>$15.72</td>
</tr>
</tbody>
</table>

Patient-specific data were abstracted at the rural hospitals from emergency department logs, administrative data systems, and insurance forms. The data items abstracted were facility, date of transfer, patient number (for tracking purposes only), age, gender, mode of transport, receiving hospital, rural ER ICD-9 code, and type of insurance coverage. For those patients that were transferred to the hub facility from the two rural emergency departments, medical records at the hub facility were abstracted by the Manager of the Emergency Department, an RN. The data elements abstracted included: hub ER ICD-9 codes, admitting ICD-9 codes, discharge ICD-9 codes, route of transfer (from rural ER to hub ER or from rural ER to direct admission at hub), patient disposition from the hub ER and, if admitted, patient disposition from the hub hospital and length of stay. Judgment of the nurse performing the abstraction was used to add an additional piece of information. This information involved aspects of the case and conditions of the patient that influenced the transfer, and necessary resources available in the rural hospital to avoid the transfer of the patient. From the data abstracted, the Emergency Department Manager, in collaboration with the Director of the Emergency Department, a physician, classified patients into one of two categories:

- patients with these conditions could appropriately be retained in rural hospitals with use of telemedicine consultation;
patients with these conditions should be transferred because of the need for specialized services not available in the rural facilities

In classifying patients, when it was not immediately obvious that the severity of the condition of the patient would necessitate a transfer, the Emergency Department Director reviewed the records with the RN to determine comfort levels with using telemedicine to diagnosis and treat the patient in the rural hospital. For those patients in the second category, the resources necessary for the rural hospital to meet their needs were identified, with attention focused on realistic expectations for rural hospitals to acquire those resources. For example, it would be unrealistic for a rural hospital to be expected to become a Level 1 trauma center, but the rural facility could provide necessary care for monitoring more complicated pneumonia patients with via teleconsultations with a pulmonologist.

During 1996, there were 9,486 emergency room visits at the two rural hospitals. Of these visits, 3,919 were at Hospital A and 5,567 were at Hospital B. There were 692 patients transferred (7.3 percent of all visits) from the emergency departments in these two hospitals: 407 from Hospital A (10.4 percent of its ER visits) and 285 from Hospital B (5.1 percent of its ER visits). Of these 692 transfers, 246 were to the hub facility: 124 from Hospital A (30.5% of hospital A’s transfers) and 122 (42.8% of hospital B’s transfers) from Hospital B. For the 692 patients transferred from the emergency departments of the two rural hospitals, only the 246 transferred to the tertiary care center serving as the hub of the telemedicine system were included in the analysis. The analysis was limited only to patients transferred to the hub facility because the telemedicine connection would enable consultations for those patients, and patient data could be retrieved from that facility.

Methodology
The model presented here provides an estimate of the reimbursement two rural hospitals would have received, if the transfer of patients from their emergency departments could have been avoided through the use of telemedicine. A number of different scenarios are presented, ranging from a conservative estimate of avoidable transfers based on current availability of resources in the rural hospitals to a more aggressive estimate based on an assumption of increased service intensity in the rural hospitals. There is an implicit assumption in all scenarios that quality would not have been compromised for the individuals retained in the rural system. Economic multipliers are used to estimate the financial impacts on communities in each scenario. Schematic 1 provides an overview of the basic model used in the development of the financial implications under each scenario.

Graph 1: Steps Involved in Determining Potential Retention of Patients in Rural Hospitals with Use of Telemedicine

- Rural diagnosis (ICD-9 code) of patient transferred
- Resources necessary to avoid need for transfer of patient
- Ability of telemedicine to meet resource needs in rural hospital
- Conversion of ICD-9 codes to DRG designation
- Estimate DRG payment for patients retained in rural hospitals
- Community multiplier effect for dollars retained locally
- Total financial impact on community of patient retained

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The use of telemedicine in the emergency room impacts the patient, the transferring hospital, the receiving hospital, the transferring community, and the receiving community. The patient receives value, with diagnosis and treatment able to begin earlier, and, especially, if there is no need to be transferred to a different hospital. The rural transferring hospital benefits by providing a higher level of care, enhancing its reputation within the community, and through an increase in revenues for individuals not transferred out of the hospital. The rural community receives benefit through both the direct income of the hospital and the multiplier impact on the increased revenues generated by the hospital. The transferring hospital and community benefits are relocated to the receiving hospital and community when telemedicine is not available to prevent the movement of patients.

Once the data were obtained and the classification decisions made regarding the ability of telemedicine to avoid the necessity of a transfer, the next step was to identify any patients that could have been treated in the rural emergency department with telemedicine consultations and retained locally. For those patients, discharge ICD-9 codes were converted to DRGs. When the ICD-9 code appeared in multiple DRGs, depending upon the complexity of case, it was assumed the DRG with the least complicated cases and, hence, lowest reimbursement rate, was applicable. For example, ICD-9 427.31 appeared in DRG 121 and DRG 138. The reimbursement rate for DRG 121 was $6,621.76, while the reimbursement rate for 138 was $3,254.65; consequently, patients with discharge ICD-9 codes of 427.31 were assigned to DRG 138.

To obtain cost information, 1997 Medpar inpatient hospital reimbursement per DRG and by state were used.\textsuperscript{32} For each DRG, Medicare reimbursement was divided by number of discharges to obtain an average national payment rate for the DRG. To adjust for location, the average Medicare reimbursement per discharge, in Missouri, was divided by the national average. This rate (98.3\%) was used to adjust each national DRG payment rate to obtain the rate applicable to the rural hospitals. To obtain total reimbursement for the local hospitals, the adjusted DRG rates were then multiplied by the number of cases determined to be avoidable transfers. The total reimbursement amount was then multiplied by the local health-sector income multiplier\textsuperscript{33} to derive an estimate of the income that could have been generated in each of these communities, with the retention of patients in the local hospital. The income multiplier associated with Hospital A’s community was 1.22 and the multiplier for Hospital B’s community was 1.23.

Since not all patients transferred from the rural communities were Medicare patients, the use of Medicare reimbursement rates tends to underestimate the financial impact on the rural hospitals. Medicaid is the only payer who consistently pays less than the Medicare rate, while most other payers use DRG weights with a higher rate of reimbursement.\textsuperscript{34} Therefore, it should be recognized that these estimates of financial implications for the rural communities are conservative. Also, the financial implications estimated in this analysis reflect only the impact on the rural hospitals and rural communities, and do not consider the impact that the reduction

\begin{footnotesize}
\begin{itemize}
  \item \textsuperscript{32}Health Care Financing Administration (1998). \textit{Short-Stay Inpatient by Diagnosis-Related Group}. http://www.hcfa.gov/stats/medpar/ss97d&s.txt
  \item \textsuperscript{33}Rural Health Policy Institute (1999). \textit{Rural Health Impact Study}. Columbia MO: Author.
\end{itemize}
\end{footnotesize}
in transfers would have on the hub facility and community. Although estimates are not made for the hub, it should be recognized that the hub community has a health sector income multiplier of 1.39 and, as a metropolitan hospital, would receive a higher DRG reimbursement rate than the rural hospitals.

Results

During 1996, the two rural hospitals transferred 246 patients to the telemedicine hub facility. Of the transfers, 124 (50.4%) were from Hospital A and 122 (49.6%) were from Hospital B. Of the transfers, 194 (78.9%) were by ground (ambulance or private vehicle) transport and 52 (21.1%) were by air (helicopter) transport. There were 113 (45.9%) female patients transferred and 133 (54.1%) male patients transferred, during 1996. In addition, 83 (33.8%) patients transferred were under the age of 25 and 53 (21.5%) were age 65 and over; the remaining 110 (44.7%) patients were between the ages of 25 and 64. The major reasons associated with patients transferred were injury and poisoning (44.7%), circulatory (14.2%), respiratory (5.3%), and symptoms ill-defined (13.8%). The major types of insurance coverage were Medicare (22.4%), private insurance (21.1%), Medicaid (18.7%), managed care (8.1%), other (7.3%), and uninsured or unknown (22.3%). Table 2 provides more detailed information about the transferred patients.

<table>
<thead>
<tr>
<th>Table 2: Characteristics of Patients Transferred to Telemedicine Hub from Two Rural Hospitals, 1996, by Hospital</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Characteristic</strong></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Miles from hub</td>
</tr>
<tr>
<td>Total number transferred</td>
</tr>
<tr>
<td>Age cohorts:</td>
</tr>
<tr>
<td>Less than 25</td>
</tr>
<tr>
<td>25 - 64</td>
</tr>
<tr>
<td>65 and older</td>
</tr>
<tr>
<td>Gender:</td>
</tr>
<tr>
<td>Males</td>
</tr>
</tbody>
</table>
Table 2: Characteristics of Patients Transferred to Telemedicine Hub from Two Rural Hospitals, 1996, by Hospital

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Hospital A</th>
<th></th>
<th></th>
<th>Hospital B</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number</td>
<td>Percent</td>
<td></td>
<td>Number</td>
<td>Percent</td>
<td></td>
</tr>
<tr>
<td>Females</td>
<td>54</td>
<td>43.5</td>
<td></td>
<td>59</td>
<td>48.4</td>
<td></td>
</tr>
<tr>
<td>Reason for transfer:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Injury &amp; Poisoning</td>
<td>50</td>
<td>40.3</td>
<td></td>
<td>60</td>
<td>49.2</td>
<td></td>
</tr>
<tr>
<td>Circulatory</td>
<td>16</td>
<td>12.9</td>
<td></td>
<td>19</td>
<td>15.6</td>
<td></td>
</tr>
<tr>
<td>Respiratory</td>
<td>11</td>
<td>8.9</td>
<td></td>
<td>2</td>
<td>1.6</td>
<td></td>
</tr>
<tr>
<td>Symptoms Ill Defined</td>
<td>21</td>
<td>16.9</td>
<td></td>
<td>13</td>
<td>10.6</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>26</td>
<td>21.0</td>
<td></td>
<td>28</td>
<td>23.0</td>
<td></td>
</tr>
<tr>
<td>Insurance Coverage</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Medicare</td>
<td>23</td>
<td>18.5</td>
<td></td>
<td>32</td>
<td>26.2</td>
<td></td>
</tr>
<tr>
<td>Medicaid</td>
<td>27</td>
<td>21.8</td>
<td></td>
<td>19</td>
<td>15.6</td>
<td></td>
</tr>
<tr>
<td>Managed Care</td>
<td>7</td>
<td>5.6</td>
<td></td>
<td>13</td>
<td>10.6</td>
<td></td>
</tr>
<tr>
<td>Other Private Insurance</td>
<td>24</td>
<td>19.4</td>
<td></td>
<td>28</td>
<td>23.0</td>
<td></td>
</tr>
<tr>
<td>Other Coverage</td>
<td>18</td>
<td>14.5</td>
<td></td>
<td>0</td>
<td>0.0</td>
<td></td>
</tr>
<tr>
<td>Uninsured &amp; Unknown</td>
<td>25</td>
<td>20.2</td>
<td></td>
<td>30</td>
<td>24.6</td>
<td></td>
</tr>
<tr>
<td>Transport Mode</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ground</td>
<td>100</td>
<td>80.6</td>
<td></td>
<td>94</td>
<td>77.0</td>
<td></td>
</tr>
<tr>
<td>Air</td>
<td>24</td>
<td>19.4</td>
<td></td>
<td>28</td>
<td>23.0</td>
<td></td>
</tr>
</tbody>
</table>

As the data in Table 2 indicate, there are slight differences in the characteristics of the patients transferred from the two hospitals, although none of these differences are significant.

Treating the data as samples from the population of persons who might be transferred, statistical tests were applied. Overall, none of the tests showed a significant difference. Specifically, two tests were performed on the age of the patients transferred. The Wilcoxon Rank Sum test showed no difference in the mean age (p-value - 0.32) and a Kolmogorov-Smirnov test showed no difference in the overall distribution of ages between the two hospitals (p-value - 0.42). The proportion of males transferred is not significantly different (p-value for a Chi-square test of homogeneity of proportions is 0.45). Similarly, no differences exist between the hospitals relative to proportions transferred by ground and air (p = 0.49), by diagnosis (p = 0.30), or by type of insurance (p = 0.26). This demonstrates that the populations transferred by the two rural hospitals are not different, increasing the ability to apply similar assumptions in the assessment of avoidance of transfers.
Of the 246 patients transferred to the hub hospital from the two rural hospitals, 161 medical records (65.4%) could be retrieved for analysis. For the 85 patients for whom medical records could not be retrieved, the reason is unknown. For example, for those patients for whom medical records could not be retrieved, it is not known if the patients did not follow through on the transfer and, consequently, not receive services; if the patients decided to go to another facility other than the hub facility indicated in the rural records; if insufficient data were available to enable records to be matched for retrieval (e.g., the social security number was missing); or if the records could not be retrieved for some other reason. Of the 161 medical records reviewed, 77 were transfers from Hospital A (62% of Hospital A’s transfers), and 84 were from Hospital B (68.9% of Hospital B’s transfers). Of the 161 patients transferred for whom patient records were available, 119 were admitted to the hub hospital (59 from Hospital A and 60 from Hospital B), 35 were discharged home (14 from Hospital A and 21 from Hospital B), and 7 were discharged to nursing home or home health agencies. Of the 119 patients admitted to the hub hospital, DRG information could be obtained on 111 patients (57 from Hospital A and 54 from Hospital B). These patients formed the foundation for the following scenarios regarding the financial implications of the use of telemedicine in rural emergency departments.

**Scenario 1**

The first scenario reflects the best estimate by the hub Emergency Department personnel of whether or not patients could have been retained in the rural hospitals with the use of telemedicine services to supplement the facilities available locally. At no time, should the discussion regarding the avoidance of a transfer be interpreted as an inappropriate transfer of the patients to the hub facility in 1996. This discussion is based on the condition
that telemedicine was available at the time of the transfer, and reflects the capabilities of the rural facilities at that time. In this scenario, only 12 of the 161 cases reviewed (7.5%) were identified by the hub ER reviewers as avoidable with the use of telemedicine; of these twelve, five were hospitalized at the hub facility and the other seven were discharged home from the hub emergency department. Assuming that the five patients hospitalized could have been appropriately cared for in the rural facilities with consultation provided by telemedicine, the financial implications are:

<table>
<thead>
<tr>
<th>Scenario 1</th>
<th>Hospital A</th>
<th>Hospital B</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Admissions</td>
<td>3</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>Hospital Revenue</td>
<td>$11,826.27</td>
<td>$7,085.68</td>
<td>$18,911.95</td>
</tr>
<tr>
<td>Community Income</td>
<td>$14,428.05</td>
<td>$8,715.39</td>
<td>$23,143.44</td>
</tr>
</tbody>
</table>

In this analysis of the financial implications for the rural hospitals and communities, it is assumed that the seven patients transferred but not admitted to the hub hospital would not have been admitted to the rural hospital, had they remained in the community for treatment. While hospitals are reimbursed for services provided on an outpatient basis, data were not collected that would enable an estimate of the revenues generated from non-hospitalized patients to be calculated; consequently, the estimated financial implications for the rural hospitals should be considered conservative estimates. On the other hand, the estimates provided consider only the potential revenues that could have been generated, and do not incorporate any costs associated with generating those revenues.

As the data in the first scenario indicate, the use of telemedicine in rural emergency departments has the potential to reduce the necessity for some patients to be transferred. However, given the nature of rural emergencies, this reduction in the need to transfer patients is not expected to be substantial. Another potential benefit of the use of telemedicine in rural
emergency departments, not incorporated in this analysis, is the ability to transfer information regarding the patient more quickly and comprehensively, thereby enabling interventions to begin earlier for patients that are transferred. Additional research is needed to investigate these potential impacts on patient outcomes.

The following two scenarios build upon the information provided in this initial assessment. These scenarios are simply “what if…” situations, in which some of the restrictions and conditions of the first scenario are relaxed. These subsequent scenarios reflect different assumptions about the role telemedicine might serve as more health professionals gain experience in its use and as rural hospitals expand their capacity to provide more resource intensive services.

**Scenario 2**

The second scenario assumes that all patients transferred with the same ICD-9 discharge codes as the five in the preceding scenario would be appropriate candidates for retention in the local hospitals with telemedicine consultations. This scenario assumes that the severity associated with these additional patients would not be too complex for the rural hospital’s resources when supported by telemedicine consultation. This assumption results in ten patients potentially remaining in the rural hospitals, with the following financial implications:

<table>
<thead>
<tr>
<th>Scenario 2</th>
<th>Hospital A</th>
<th>Hospital B</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Admissions</td>
<td>5</td>
<td>5</td>
<td>10</td>
</tr>
<tr>
<td>Hospital Revenue</td>
<td>$19,685.49</td>
<td>$16,849.63</td>
<td>$36,535.12</td>
</tr>
<tr>
<td>Community Income</td>
<td>$24,016.30</td>
<td>$20,725.04</td>
<td>$44,741.34</td>
</tr>
</tbody>
</table>

Scenario 2 relaxes the consideration that ICD-9 codes can contain patients with varying levels of severity and assumes that the rural hospitals could adequately treat the additional
patients with those diagnoses. As the data indicate, this assumption does not increase substantially the number of patients potentially retained by the rural hospitals, nor the potential revenues generated for the hospitals.

**Scenario 3**

The third scenario assumes that patients transferred with one of the top 20 DRGs treated in non-metropolitan hospitals in Northwest and Central Missouri could have been retained in the rural hospitals with the use of telemedicine. This assumes that the increased complexity of the patients transferred could be treated appropriately through the use of telemedicine consultations at the hub facility. The assumptions in this scenario resulted in 22 potential patients being retained by the two rural hospitals. The financial implications associated with this scenario are:

<table>
<thead>
<tr>
<th>Scenario 3</th>
<th>Hospital A</th>
<th>Hospital B</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Admissions</td>
<td>12</td>
<td>10</td>
<td>22</td>
</tr>
<tr>
<td>Hospital Revenue</td>
<td>$49,764.72</td>
<td>$40,117.31</td>
<td>$ 89,882.03</td>
</tr>
<tr>
<td>Community Income</td>
<td>$60,712.96</td>
<td>$49,344.29</td>
<td>$110,057.25</td>
</tr>
</tbody>
</table>

Scenario three represents more aggressive assumptions regarding the ability of the rural hospitals to provide services to more severely ill individuals with the assistance telemedicine can provide. Even with these assumptions, however, it is anticipated that rural hospitals can retain less than 15 percent of the patients transferred from their emergency departments. Such results should raise a cautionary flag, and certainly indicate a need for more extensive studies before substantial resources are invested in placing telemedicine equipment in rural emergency departments, with the anticipation of increased retention of patients in the rural hospitals. It should also be recognized that the above financial estimates
do not include the potential for improved outcomes for transferred patients because of increased information transmitted prior to transfer.

**Discussion**

The three scenarios presented here are based on only two rural hospitals and reflect the mix of patients transferred prior to the implementation of telemedicine in the communities. Additional research is needed to expand the number of facilities reviewed and to observe the actual difference telemedicine makes after the equipment has been installed for a sufficient period of time for it to gain acceptance and widespread utilization. However, given the evidence uncovered here, it appears very doubtful that these small, rural emergency departments would ever achieve substantial reductions in the transfer of patients.\(^{35}\)

The information derived in this evaluation project indicates that the direct financial implication of telemedicine for rural hospitals’ emergency departments is small. Based upon the 161 transferred patients in this study, only 12 were identified as warranting the application of telemedicine to avoid the transfer. Of these 12, only five were admitted to the hub hospital after transfer. The financial benefits reported in this study reflect the value of the revenue generated to the hospital, and the subsequent impact of those dollars on the local community; they do not necessarily incorporate the full value of telemedicine services. In addition to these direct financial benefits, telemedicine also has the potential to benefit:

- patients and family and friends, by reducing the direct and indirect costs of traveling to distant facilities;
- employers, by reducing absenteeism from work by having services closer;
- health care providers, by increasing financial health of the hospital;

< community members, by increasing resources to act as catalysts for economic growth;

< patients, by allowing earlier diagnosis and interventions, even when transfers are necessary.

The financial implications and value of telemedicine described in the scenarios of this analysis are applied only to the 246 patients transferred from the two rural hospitals to the hub facility, and does not include the patients transferred to other hospitals (an additional 446 patients). It would not seem unreasonable to assume that telemedicine would also be used with some of those patients as well, avoiding additional transfers and further improving the financial position of the rural hospitals and the economic health of their rural communities.

The availability of the telemedicine resources in the emergency department does not guarantee their use. Emergency services, by definition, require a quick response and quick action. If the telemedicine equipment is not readily available, or needs some preparation, it will likely not be used. In addition, until the value of the new technology is demonstrated, it is also likely not to be used. Telemedicine will only be implemented and utilized at the appropriate level, if it can be proven to provide quality care to the patient that is financially advantageous to both the local hospital and to the community.

The findings reported from this study should not be interpreted as meaning telemedicine in rural emergency departments is not financially feasible. These findings do, however, illustrate the importance of evaluating carefully the conditions under which it is implemented. For example, Greece has used telemedicine for a number of years, with positive results, in an environment where weather and numerous islands make travel unpredictable, at best.36 Other areas, where rural facilities are further from the hub facility or

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provide more resource-intensive services might be able to utilize telemedicine more effectively
to avoid the transfer of emergency department patients than was found in the two facilities in
this study. This evaluation study begins to demonstrate the potential value of telemedicine use
in rural emergency departments to patients, rural hospitals, and rural communities. More
comprehensive studies are necessary as telemedicine becomes more widely accepted and
used to determine the value it adds to the health care system and to the economy.
EVALUATING TELEMEDICINE:
APPROPRIATE PRICING FOR TELEMEDICINE SERVICES

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EVALUATING TELEMEDICINE:
APPROPRIATE PRICING FOR TELEMEDICINE SERVICES

The health care industry is changing rapidly, as new technologies and organizational structures are introduced. One such technology that is shaping the future of transactions and relationships in the health care industry is telemedicine. Telemedicine, broadly defined, is “the use of electronic information and communications technologies to provide and support health care when distance separates the participants.”¹ This broad definition encompasses clinical, educational, and administrative activities associated with the health care system. As telecommunication equipment is used for multiple purposes, its value to the multiple users must be evaluated. Appropriate evaluation is essential to the appropriate adoption and utilization of telemedicine technologies, and to the establishment of appropriate prices for telemedicine activities.

Pricing is an extremely important issue, capable of expanding or preventing the expansion of telemedicine use. This article will explore two issues. The first is the development of a framework for the analysis of pricing of telemedicine services; the second is the application of this framework to a specific Rural Telemedicine Evaluation Project/Rural Telemedicine Grant Project (RTEP/RTGP) example.

The evaluation of telemedicine takes place on a variety of planes, or levels. In attempting to evaluate it, an assumption is made that it is already in place--the equipment is physically located where it can be used, a communication infrastructure exists, contracts have been acquired for its use, etc.--and decisions are being made about its use and utility. Should

it stay? Should it be eliminated? Should it be expanded? Should it be introduced to new areas?

There are several limitations to this discussion, and to the evaluation of telemedicine included in the RTEP/RTGP study. One limitation is that telemedicine is relatively new and not broadly disseminated. Neither physicians, patients, nor any other parties to the health services interaction have a great deal of experience, if any, with the myriad of resources available through this new medium. Change, in general, has been shown to result in stress, and health care is no exception. The delivery of health services is often associated with increased stress, even before the introduction of a somewhat different way of delivering the service.

There has been a limited market for telemedicine. To a certain extent, it is still in the experimental stage, since the potential benefits (and costs) have not yet been completely explored. Additionally, in the past (including the situation involving RTEP/RTGP), telemedicine resources and structures have been heavily subsidized, making it difficult to identify the true costs of developing and maintaining a telemedicine structure. Telemedicine may not look the same, and may not provide the same benefits, had it been developed without the subsidy. On the other hand, without the subsidy, it may never have developed. There is a major social issue involved in the implementation of telemedicine. If social benefits are found to outweigh social costs, while private costs outweigh private benefits, then a subsidy is necessary for the continuation of telemedicine.

**Project Attributes**

Evaluation of telemedicine is difficult when thinking about the pricing issue, because it becomes necessary to characterize telemedicine along its attributes, or characteristics. Is
it a social program? Can and should it be provided (at least technologically) by private enterprise? To what extent should pricing play a role in the future of telemedicine? Is there any totally private mechanism by which telemedicine can exist? There has been a great deal of evaluation literature written over the decades; however, the preceding questions have not been answered by the previous evaluations of telemedicine. One author,\(^2\) in a non-technical publication, provides a listing of key ideas involved when a program or project has multiple attributes:

1. When possible, evaluations should be comparative.
2. Programs normally serve multiple constituencies.
3. Programs normally have multiple goals, not all equally important.
4. Judgments are inevitably a part of any evaluation.
5. Judgments of magnitude are best when made numerically.
6. Evaluations are, typically, or at least should be, relevant to decisions.

As mentioned in the book from which this list is taken, some of these points are less innocent than they may at first appear. The first two, especially, raise a major issue when examining pricing or payment issues.

**Comparative Evaluation**

The first attribute, stating that evaluations should be comparative, encompasses the basic economic concept of marginalism: compared with the traditional method, is there an incremental cost associated with the use of telemedicine? An affirmative response to this question provides one of the answers as to why telemedicine is so difficult to evaluate, and why, in many cases, it is being found not to be worth the additional cost.

An important issue involved in the evaluation of telemedicine is its role in the health services system. Telemedicine, in some cases, can be viewed as a substitute for some health

services; for examples, it is a substitute for a face-to-face encounter. On the other hand, it might also be an add-on, in cases where the encounter might not have otherwise taken place. In this latter case, there may be an improvement in quality due to earlier diagnosis or beginning of treatment, but this quality is difficult to quantify.

The second issue raises the following question: Who are the constituents? To what extent do the different stakeholders benefit from the existence of telemedicine? What are the different objectives of the constituencies? Any approach to pricing must first address these questions.

Constituencies

A comprehensive evaluation model has been developed by the University of Missouri RTEP/RTGP team. In this model, the constituencies were broadly combined into three categories: individual, community, and society. Most evaluations, however, especially ones dealing with pricing, must be more explicit in identifying the specific constituencies, sometimes referred to as stakeholders, being considered. An attempt to develop a complete listing of more specific categories of constituencies would include the following (in no particular order):

1. Patient(s)
2. Friends, relatives, neighbors, and other individuals that might provide assistance to the patient(s)
3. Primary care physician(s)
4. Specialty physicians
5. Hospital(s) located in rural or remote area
6. Hospital(s) located in hub community, generally capable of providing a higher level of care than the hospital listed in 5
7. Employers of patients and those listed in 2 (when considering work time)

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8. Employers of patients and those listed in 2 (employer as payer)
9. Rural or remote communities
10. Hub communities
11. Federal government (as payer)
12. Federal government (as purveyor of public policy)
13. Providers of telemedicine technology
14. Providers of communications mechanisms
15. Private insurers
16. State licensing authorities

This is probably not a complete list. The important point is to recognize that each of these constituencies has a different objective, and, in some cases, the objectives may even conflict. Lists of the advantages, or objectives, of telemedicine have been provided elsewhere, but none of these lists have attempted to handle the complete list of constituencies, so many have missed at least some of the objectives. For instance, in the US, there have been occasional debates over the extent to which a rural lifestyle should be supported. Telemedicine makes it easier for individuals to live in remote parts of the country without giving up access to specialty consultations. In the future, telemedicine may be capable of providing the majority of services provided by these specialists, including surgery.

No attempt is made to list the various objectives associated with the above list of constituencies. Suffice it to say that each of the stakeholders listed has its own objectives, and

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all will react to any incentives placed before them. Incentives (rewards, benefits) may take financial or non-financial form. It should be obvious, however, that telemedicine will not succeed unless some of the needs of an adequate number of sufficiently powerful constituencies are met. This caveat is an attempt to recognize the political realities involved in order for any change to take place in the highly visible health services arena. Pricing mechanisms can be used to provide important incentives for many of these groups. However, the objectives of several of these groups are difficult to quantify.

Consider the first stakeholder listed – the patients. The patients located in a rural community are often an advocate of telemedicine for the following reasons:

1. It provides access to specialty care services, locally. This improves the quality of health services, the quality of life, and increases confidence in the local facility and physician.

   **Pricing issue:** The patient might be willing to pay a premium for the opportunity to use telemedicine, as opposed to traveling to a geographically separated specialty clinic. Under managed care, the managed care organization might recognize a benefit associated with earlier diagnosis and intervention, and prefer the use of telemedicine services as a cost reduction tool.

2. This easy access to specialty care should result in a greater demand for local health services, as individuals may be willing to see the primary care physician earlier in the disease process, resulting in earlier diagnosis, and introduction of treatment regimens. There is also an expected increase in compliance. Thus, the health status of the individuals within the community should be enhanced.

   **Pricing issue:** The value of patient convenience should not be underestimated. Confidence in the capabilities of the local primary care provider (PCP) may result in increased willingness to approach the PCP with health issues. Earlier diagnosis and intervention impact on health services cost is far from certain, while impact on health status becomes obvious. Is this a social issue, to be discussed in the public arena, as a cause celebre for subsidy? Or is it a private

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issue, involving the willingness of the isolated patient to pay a premium for this service.

3. It reduces: the amount of time it takes to receive care, travel times, time off work, time of an accompanying person, risk of being on the highways, etc. There is a value to this convenience, some capable of quantification and some not.

**Pricing issue:** This benefit accrues to the patient, a companion, an employer. How can this benefit be captured? Should employers be willing to help subsidize the telemedicine resources? Once again, this is a social issue, to be decided at the community level.

4. It lowers transportation costs substantially, due to the closer proximity of the telemedicine site to the patient. This transportation cost reduction applies not only to the patient, but any individual who may need to accompany the patient.

**Pricing issue:** This is an indirect cost to the patient and any companion. This may provide room for capturing some of the benefits, through pricing telemedicine services somewhat higher than face-to-face visits.

5. There will be fewer referrals, meaning that the patient will receive care in the local community. The fewer referrals will come about for at least two reasons: the first is that diagnosis and treatment decisions can be made via telemedicine, in some cases. The second is that, over time, the primary care physician will become more experienced in the types of conditions that do not need referral.

**Pricing Issue:** This is an issue of managed care, where the appropriate services are delivered by the appropriate professional, at the appropriate location. This is a benefit to the health system, under an appropriately designed payment system. Alternatively, historical fee-for-service payment may prevent this benefit from being realized.

6. Better coordination and continuity of care will occur, resulting in improved patient satisfaction and quality of care and life. This will come about as a result of earlier intervention. Earlier intervention, and easier referrals, will take place due to the fact that the patient is more easily scheduled. The ability to schedule will be a function of the physician’s schedule, rather than a matching of the two schedules.

**Pricing Issue:** Similar to the previous, this benefit will not be realized if payment mechanisms create disincentives for telemedicine usage. The value of convenience of access to services should be recognized by payers. Sufficient research has not yet taken place regarding the economic impact of earlier intervention. Coordination and continuity of care has been a stated trademark
of managed care, yet the benefits are more easily associated with quality of health than with cost.

7. Improved information flow to the patient, due to services being received locally, will require input and knowledge to be gained and transferred by the primary care physician.

**Pricing Issue:** The main impact here will be on the knowledge base of the local, primary care physician. A more knowledgeable physician is a more confident physician; a more confident physician makes for a more compliant patient; a more compliant patient results in improved health.

The overall issue here becomes, if there is a benefit to the patient from having telemedicine available, is there any way of capturing the value of that benefit? The patient may be willing to pay a positive price for the improvement in health service capabilities of the local community, the individual convenience of not having to travel, and the improvement in health status realized. But, how can/should this value be captured? In the current system, the payment mechanism is generally established between the provider and the insurance company, with the patient agreeing to pay only a co-payment or co-insurance amount. If the patient were willing to pay a surcharge (tax) on top of the normal bill for the use of telemedicine, this “tax” could be collected at the point of service. However, if all patients are asked to pay a surcharge to help pay for the availability of telemedicine services, then those not using the telemedicine equipment would subsidize those who used it. Such subsidies are often justified on the premise that non-users are simply paying for the increased personal security associated with having services available, if needed.

A previous study has examined the relationship between fee-for-service (FFS) payment and telemedicine use, and determined that FFS provided a barrier to the use of
The major reason that FFS payers have not been willing to pay for telemedicine consultations is the fear that the cost of health services will escalate due to increased use of both appropriate and inappropriate services. Payment mechanisms will have a major impact on the extent to which the potential of telemedicine is realized. However, payment by the third parties is only one aspect of the funding or financing mechanism that provides incentives. “If … telemedicine is not accepted as cost effective and is not incorporated—one way or another—into the everyday financing of patient care services, it will be difficult to sustain telemedicine once grants expire, donated equipment becomes outdated, and routine operating as well as up-front capital costs have to be covered.”

**Multiple Goals**

The third attribute listed states, “Programs normally have multiple goals, not all equally important.” Telemedicine equipment, once in place, can be used for other functions, besides clinical, where video and audio exchanges are feasible. Telecommunications equipment can be, and is being, used for administrative and educational functions. On the administrative side, meetings can take place involving individuals at multiple, geographically diffused sites. Some of the advantages and goals associated with the clinical use of the equipment are the same for administrative and educational uses. Emergency meetings can take place among these individuals, reducing travel when face-to-face encounters are not required.

Closely associated with the clinical use of telecommunications equipment is its use for clinical instruction. One study examining cardiology found that “tele-instructed

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11 Field MJ, ed (1996):113
echocardiography was also an excellent education tool, allowing an inexperienced examiner gradually to take responsibility for the local echocardiographic service.”¹² Clinical education is only one additional use of the equipment. Continuing medical education for an individual, a classroom, an auditorium, multiple auditoriums, or any combination of rooms, is also possible. The educational use of the equipment is also a benefit, and the equipment can be used for educational activities during the off-peak clinical time periods.

One issue that arises, when discussing the three activities—clinical, educational, administrative—associated with the video telemedicine equipment, is the weighting (or relative value) to be placed on each. That is, it is commonly accepted that the clinical use of the equipment has the highest priority. Except in extreme circumstances, or experimental usage, the equipment would not be put in place only to serve educational and/or administrative functions. It is perceived that the benefits would not be sufficient to outweigh the costs. However, once the equipment is in place, any excess capacity could be used for other functions. As long as there is excess capacity, this time could be sold to outside entities wishing to provide educational programs or administrative assistance to the remote site. For this to take place, it is necessary to understand more fully the costs involved. This understanding is necessary in order to develop a pricing structure that might be considered “fair.”

Judgments

The use of telecommunications technology to aid in the delivery of health services has been growing at unprecedented rates. This is a worldwide trend, with Finland, Norway, and other Scandinavian countries leading the way, primarily due to the large distances involved between health providers. However, many of the anticipated advantages of telemedicine have not yet occurred. One reason for this is the lack of appropriate incentives. These incentives are most often provided by the reimbursement mechanisms that are in place.

In many countries, reimbursement for telemedicine consultation is likely to be the most critical issue determining the extent to which telemedicine is able to reach its potential. And, since different constituencies, and different individuals within each of the constituencies, place a different value on the use and outcomes of telemedicine, consensus on an appropriate price is lacking. Pricing determines usage rates, provides incentives (or disincentives) for use, determines viability of a new product, establishes barriers or breaks down walls. Pricing can destroy the potential of telemedicine, if used inappropriately, or can be used to encourage its success.

In this paper, the terms pricing and reimbursement are used somewhat interchangeably. To the extent that both determine the amount of money received by the specific parties to the transaction, incentives are created relating to utilization and acceptability. These incentives, together with the amount of monies gained from the transaction, determine the value of the service. Value, however, is determined by factors beyond the price or amount of reimbursement. Issues of quality and access also create value for telemedicine.

**Pricing Theory**
Competition has, historically, had a major role in the pricing of products and services in the United States. In a competitive environment, marginal costs are said to drive price. Eventually, the price will be exactly equal to the cost of providing the service. This cost includes a reasonable rate of return on resources used (generally referred to as profit). When this occurs, individual’s willingness to pay determines the extent to which the product is sold. Individuals have utility functions that determine the psychological value they place on the item. This utility is often called the benefit of the item. This benefit is compared with the cost of the item. The most common economic decision made is by comparing the benefits with the costs of a transaction. As long as the benefit outweighs the cost of a specific item, the item will be purchased. If the cost outweighs the benefit, the item will not be purchased. Every decision to purchase or not to purchase is based on this concept.

This concept is called benefit-cost analysis, and all parties to a transaction compare the benefits with the costs. What does this mean for the production of telemedicine services? There are numerous individuals and organizations involved in the production and delivery of health care services. Many of these individuals and organizations interact (perform transactions) with each other on a continuing basis. These transactions drive quality, cost, and access within a health system. Ideally, all parties involved in the interaction should believe the benefits outweigh the costs. Realistically, either a sufficient number of stakeholders, or stakeholders of sufficient political clout, must realize benefits greater than costs for the transaction to take place. Therefore, the actual cost of the technology must be paid sufficiently for it to be provided on a continuing basis. In some countries, taxes guarantee the availability of the technology. In the United States, it must be determined that the benefits are “worth it”
before the public will be willing to pay taxes to support it. It is not clear, however, that a tax subsidy is necessary.

There are many individuals involved in the delivery of health services: patient to physician, physician to physician, physician to hospital, patient to hospital, payer to patient, payer to physician, payer to hospital, etc. As mentioned earlier, this is an extremely complex system, with numerous transactions. The introduction of telemedicine further increases the number of transactions. This increase is shown in Figure 1.

In Figure 1, Box A demonstrates the normal patient-physician interaction in a face-to-face visit. Box B demonstrates the physician-patient interaction via telemedicine. There is
no difference in the parties involved in the interaction, but there is a difference in the interaction, created by the involvement of the technology. This involvement of technology is seen by many as an aid to the transactions, but for some, it represents a barrier. As the technology improves in quality and ease of use, and as experience with the technology increases, telemedicine use should become less intrusive into the interaction. Currently, however, this increase in complexity of the transaction may result in a situation where total benefits outweighing total costs may not be sufficient to guarantee the success of its utilization.

**Pricing in Practice**

Pricing, in practice, basically means that the telemedicine technology must be paid for, one way or another. Likewise, each individual involved in the transaction must feel that he/she can benefit through the use of telemedicine, or, at the very least, an adequate number of sufficiently influential stakeholders must feel that they can benefit. Therefore, providers must earn at least as much as they would have earned prior to telemedicine. Employers of providers, and hospitals, must feel that they are better off using telemedicine. Likewise, patients must feel that the quality of care received is at least as good as that received in the absence of telemedicine. Finally, and probably, the most difficult stakeholder in the transaction is the payer. Telemedicine might very well result in an increase in health services delivery, resulting in increased costs to the system; and someone must pay for these costs.

Up to this point, the discussion has dealt with the concept and philosophy of pricing, and the extent to which pricing (and payment or reimbursement) policies will impact the success or failure of telemedicine. The direction of the discussion is now shifted to a specific application of pricing within the RTEP/RTGP project. This application is much narrower in
scope than the policy issues discussed previously, but will demonstrate a particular methodology for pricing specific services.

The first pricing determinant developed for this project dealt with the use of the telecommunications equipment. Equipment cost, communications cost, personnel, and other costs involved in establishing the telemedicine capabilities were used to determine a pricing structure that could be used to charge for its use. The initial concept behind this pricing strategy was to charge for non-clinical use of the telecommunications equipment. Economic theory explains the relationship between cost and price. The accounting term full cost refers to the total direct and indirect costs associated with production of a product or service. Over the long term, revenues generated must be sufficient to pay for these full costs. Thus, any pricing mechanism must take into consideration the recovery of full cost. Full cost pricing, however, is not sufficient to guarantee success.

An additional economic concept must be introduced before presenting a discussion of the cost of the telemedicine equipment and usage. This is the idea of joint production. For example, once the telemedicine equipment is in place, it can be used for a variety of activities. Most evaluation research into the use of telemedicine has focused primarily on the clinical use of the technology. However, telemedicine equipment can just as easily be used for administrative and educational purposes.

The following is designed to establish a pricing structure for the use of the telemedicine facilities for non-clinical activities, such as education, administration, and conferences. The objective of the pricing structure was to recover all direct costs associated with the use of the telemedicine facilities and to recover a prorated portion of the fixed costs of the facilities and equipment. While the initial intent of the pricing structure was also to include a contribution
margin above costs of five percent, the pricing structure was so dependent on the assumptions regarding economic life and usage rates that a contribution margin concept was inappropriate.

A basic assumption in the development of this pricing structure was that all non-clinical use would involve a basic set of services from the telemedicine facilities, but some types of utilization would require additional services and resources from telemedicine. As a result, the establishment of a single hourly use rate for all activities was not appropriate; instead, a menu of services with associated prices needed to be developed. The assumed market for these services include:

1. Academic programs, such as the nursing school
2. Physician use, for purposes including continuing medical education (CME)
3. Non-health care groups, for training, town hall type meetings, open forums, etc.
4. Other users, for whatever purpose

The driving forces for the use of the network is not the individuals, but the function that can be served by having access to the telemedicine transmission facilities. For example, individuals and groups of individuals are capable of communicating, sharing graphics and diagnostic results, and making decisions requiring both audio and video communications, while being geographically separated. It is believed that the listing of assumed markets for these services above is too narrow and incomplete, and will be expanded as the needs dictate.

A major issue integral to developing a pricing structure is an accurate and comprehensive identification of all resources (equipment, personnel, supplies, overhead, etc.) used in the production of each type of service. These resources must be divided into those that occur regardless of the type of non-clinical activity performed and those that are specific to a particular activity. Once the physical quantities have been identified, it is then necessary
to establish a “cost” associated with the use of each resource. This “cost” should reflect the acquisition price of the input used in the activity, not the billed charges historically associated with the use of the resources. Using billed charges as a proxy for costs usually substantially over estimates the actual cost of the resources used to produce the activity. Often times in the health care industry, there is only a very weak relationship between the billed charges and the economic resource costs.\textsuperscript{13,14}

In order to develop the pricing structure, a series of scenarios were developed, in terms of what a “typical” use of the telemedicine facilities might include. While the development of the assumptions in the series of scenarios was not an easy task, it was an important undertaking for the consideration of the costs of usage. These assumptions provide the foundation for establishing the prices of alternative uses, and enables participants in the process to understand the rationale for each component included.

For example, a potential usage might be for a four-hour CME session for a group of 12 physicians. In order to provide this service, there would be a technician on hand at both the sending and receiving ends. In addition, depending on the site, there could be setup requirements for the facilities on both ends. Once the equipment is engaged and running, the continuing operations are relatively straightforward, and the primary costs are transmission time, and technician standby costs. After the session, shutdown procedures must be performed on each end, facilities must be cleaned, plus any other associated activities quantified. In this case, resources used would include the following:


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transmission and receiving equipment
facility space -- setup and takedown, clean up.
technician time and expertise
transmission time

It is possible that training to operate the system would be desired, so that a technician
would not be needed on site, at either end. In this case, an estimated two-hour training
session could be provided on a one-time basis. During the presentation time period,
however, it might still be necessary for a technician to be available, on a standby basis, to
handle any emergencies.

The above is simply one possible scenario to demonstrate the pricing requirements.
In order to place a pricing unit on each component, it is now necessary that the following
questions be answered:

1. What is the scope of the activities that, collectively, make up “non-clinical” and clinical
activities for the telemedicine facilities?

2. What resources are used in the production of each of these activities?
3. What are the costs associated with each of these resources?
4. What forces exist that may require significant revisions of the current best estimates of the
scope of activities?
5. What forces exist that may require significant revisions of the current best estimates of
the costs of the resources?

It must be understood that pricing is an art, and not a science. Thus, while costs are
one consideration in the pricing of services, they are not sufficient for the development of a
comprehensive pricing strategy. Only through consideration of the potential market for these
services can a pricing structure be developed which meets objectives. Short-term marginal
costs create a floor for the price above which some contribution is made towards covering the
fixed costs. The following is a preliminary list of the specific items to be priced:

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transmission and receiving equipment
facility space
technician time and expertise
transmission time
training time

The basic pricing mechanism for use of the telemedicine equipment includes the following cost items:

<table>
<thead>
<tr>
<th>Equipment: (expected life of 2-6 years)</th>
</tr>
</thead>
<tbody>
<tr>
<td>V-tel dual 27&quot; Video Conferencing System</td>
</tr>
<tr>
<td>CSU/DSU</td>
</tr>
<tr>
<td>Elmo Document Camera</td>
</tr>
<tr>
<td>35 MM Slide to Video Transfer Unit</td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Operating Costs (per year):</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1 service</td>
</tr>
<tr>
<td>Analog Service</td>
</tr>
<tr>
<td>Key Salaries and Benefits</td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Additional Items for Rent:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electronic Stethoscope</td>
</tr>
<tr>
<td>Electronic ENT Instruments</td>
</tr>
<tr>
<td>Teleradiology</td>
</tr>
</tbody>
</table>

It is important to note that all of the cost items listed above are fixed costs—they do not vary with the use of the telemedicine equipment or services. Once purchased, their costs do not change with the type or amount of use. This has important pricing implications, since the short-term marginal costs are, essentially, zero. There may be some short-term marginal costs not included in this study, to the extent that personnel may be used to set up chairs and tables, and to clean up the facilities and put tables and chairs back in their original position and condition. These issues should be addressed more thoroughly, as a menu of prices unique to each site is developed.
Cost determinations were made based on a variety of assumptions, regarding both the expected life (in years) of the equipment, and the number of hours of expected use per year.

Expected life of equipment was assessed as being varied from two to six years, and number of hours used per year was varied from 2,080 (full-time) to 1,040 (half-time) to 520 (quarter-time). Table 1 shows the results of these calculations. For instance, with an expected life of the fixed equipment of four years, and an assumed utilization rate of 520 hours per year (1/4 time), the total of equipment and operating costs amounts to $85.99 per hour. This is the sum of $34.61 per hour equipment costs and $51.38 operating costs. These numbers are presented in bold in Table 1.

<p>| TABLE 1: COSTS FOR TELEMEDICINE UTILIZATION FOR TEACHING, SEMINAR, AND CONFERENCE |
|---------------------------------------------------------------|---|---|---|---|---|---|</p>
<table>
<thead>
<tr>
<th><strong>Equipment</strong></th>
<th><strong>Expected Life of Equipment</strong></th>
<th>2 Years</th>
<th>3 Years</th>
<th>4 Years</th>
<th>5 Years</th>
<th>6 Years</th>
</tr>
</thead>
<tbody>
<tr>
<td>V-tel Dual 27” Video Conferencing System</td>
<td>$60,000</td>
<td>$14.42</td>
<td>$9.62</td>
<td>$7.21</td>
<td>$5.77</td>
<td>$4.81</td>
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<tr>
<td>CSU/DSU (Split lines for video)</td>
<td>$4,995</td>
<td>$1.20</td>
<td>$0.80</td>
<td>$0.60</td>
<td>$0.48</td>
<td>$0.40</td>
</tr>
<tr>
<td>Elmo Document Camera</td>
<td>$3,995</td>
<td>$0.96</td>
<td>$0.64</td>
<td>$0.48</td>
<td>$0.38</td>
<td>$0.32</td>
</tr>
<tr>
<td>35MM Slide to Video Transfer Unit</td>
<td>$3,000</td>
<td>$0.72</td>
<td>$0.48</td>
<td>$0.36</td>
<td>$0.29</td>
<td>$0.24</td>
</tr>
<tr>
<td>Total Equipment Costs</td>
<td>$71,990</td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hourly Rate @ 2080 Hours/Year</td>
<td></td>
<td>$17.31</td>
<td>$11.54</td>
<td>$8.65</td>
<td>$6.92</td>
<td>$5.77</td>
</tr>
<tr>
<td>Hourly Rate @ 1040 Hours/Year</td>
<td></td>
<td>$34.61</td>
<td>$23.07</td>
<td>$17.31</td>
<td>$13.84</td>
<td>$11.54</td>
</tr>
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Evaluating Telemedicine – Appropriate Pricing

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November 30, 1999
Given the fact that costs are primarily fixed, it is assumed that it is appropriate to use time as the major price-determining factor. That is, charge rates should be expressed on an hourly rate. Simplicity in pricing is also preferred and easily developed for telemedicine. At the present time, a single hourly rate would include equipment and operating costs (shown as Basic Package Cost under Assumptions in the table). Additional items would include the Electronic Stethoscope, Electronic ENT instruments, and use of the Teleradiology Equipment, all priced at hourly use rates. It is appropriate to price set up and tear down at a fixed rate, to be determined by the size of the facilities used and effort involved. An additional item to consider in the pricing is training, which could very well be included in the hourly rate; e.g., price includes two hours of training for two individuals.

As the capabilities for additional sites, and the use of larger sites, become more prevalent, a price based on the number of participants may also be a method for increasing revenues. However, the only cost impact of increasing the number of participants appears to be on the facilities. A possible exception to this might occur when training in the use of the

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electronic instruments is being performed, in which case an additional fee for wear and tear on the equipment may be warranted.

Training costs of $30 for one hour appear to be reasonable for personnel. Depending upon the amount of equipment costs to be recovered, an hourly charge of $100 that includes the hour of training appears to be reasonable. If the user wants a person on-site to run the equipment and monitor the activities, an hourly charge of $150 would provide sufficient incentive to get training and run their own. Of course, as the number of hours of use increases, the hourly rate should be decreased appropriately. For instance, given a situation where a group wishes to use the equipment for a total of 12 hours over two days, a lump sum of $800 might be appropriate.

**Caveats**

The rates discussed so far do not include any space costs, although a charge of $100 per hour could be assumed to cover the space rental. Additional set-up costs might be incurred and would have to be determined at the site. Averages of such costs could be used here.

The marginal costs of using the equipment are minimal, and almost completely personnel based. Operating costs (such as utilities) that are variable are not currently measured and are assumed to be minimal; additional issues for consideration include the following:

1. In the rural hospitals, the equipment is usually on rolling units, so it can be located where needed. The specific locations of need must be anticipated, however, since T1 or ISDN connections must be available at those locations. These units are normally in the emergency room. When needed elsewhere, the equipment must be moved to a different site, perhaps connected to a projector or otherwise adjusted to meet the immediate needs of the user. Then, when a patient needing specialty consult comes into the emergency department, the equipment would need to be moved back into the
emergency room. The time that this would take is not permissible in an emergency, and could result in a liability situation. In addition, movement of the equipment might result in it not being ready to use on a moment’s notice in the emergency room, once again violating the basic principles of emergency room care. The result of this is that emergency room use of the telemedicine equipment and services has not been as widespread as hoped.\(^\text{15}\) This represents a barrier to the use of telemedicine in the emergency room, created by both lack of availability on an immediate basis and a lack of ease of use. Over time, as emergency room personnel have the opportunity to experience the benefits of telemedicine use, its value will become more widespread. However, it may be necessary for the emergency department to have an easy-to-use, dedicated, telecommunications system for this to take place.

2. There are three different variations of what is included and what is not, provided in the lower section of Table 1. In addition to the basic package, costs are presented for the use of an electronic stethoscope, electronic ENT instruments, and teleradiology. These costs would only apply to users wanting access to these special features and equipment.

3. Currently, it is not possible to hook up a computer to the transmission units, so spreadsheets or computer graphics cannot be used effectively. Teleradiology communication is computer to computer. This limitation might be overcome relatively simply, as cost is reduced, and benefits of such transmission are realized. The technology exists, and is currently being utilized in distance education applications.

4. Cost/pricing will depend on the number of sites being utilized. For instance, the cost figures that were given are for one site. For two sites, then the price should be doubled, or $200 per hour plus space, setup, personnel at each site. There should be a sliding scale, such that with a total of four sites, for example, the cost/price might be set at $350, and for eight sites, it might be at $600 (plus space, setup, personnel). There are definite economies of scale in providing identical access to multiple sites. While some costs are fixed, and site specific, once the information is available in an electronic format, then it can be transmitted not only to other telemedicine sites, but also to individual computers.

Conclusions

The primary objective of this paper was to present the multiple issues involved in attempting to pay for telemedicine equipment and infrastructure. There were multiple benefits associated with the use of telemedicine, to multiple constituents. Many of these benefits were

subjective, non-quantifiable, and more social in nature than private. This made it difficult to
develop a payment strategy capable of ensuring that those who benefit pay for the value
received. On the other hand, there are a variety of social issues and benefits, more
appropriately captured, and paid for, through social programs. These programs generally
require some form of taxes to pay for them.

Evaluation of telemedicine is necessary to provide evidence as to its relative value.
However, this evaluation would ideally capture all benefits (and costs) to all potential
beneficiaries. A realistic approach to evaluation requires an emphasis to be placed on the
most important and/or most influential impacts. Care must be taken to ensure that evaluation
ignores the incentives present in the current environment, both positive and negative, to the
extent that they interfere with the interaction. In other words, there may be perverse incentives
that work to counteract real benefits, and the effects of these incentives must be considered
when assessing the overall benefits of telemedicine. For example, the legal restrictions on fee
splitting makes it difficult to have a transaction take place which might require a physician on
both ends.

If it is determined that telemedicine provides benefits greater than the costs, then a
mechanism must be developed to encourage its dissemination across the multiple health care
dimensions. It will then be necessary to incorporate a multi-faceted mechanism of paying for
the technology, infrastructure, and any other aspect needed for the continuing operation,
upkeep, and replacement as new technology is developed. A benevolent dictator might be
able to design such a structure. However, a competitive market, with multiple payers and
multiple providers (and multiple types of providers) works to ensure that the pricing of
telemedicine services will be neither orderly nor simple. Nonetheless, the following discussion
attempts to describe some of the required characteristics of this pricing system.

The multi-faceted payment mechanism must include structures capable of capturing
private benefits, when they can be measured. Thus, a discussion of cost recovery for
educational and administrative uses has been included. Some of the clinical benefits can be
captured by individual clinics. Hospitals also gain benefits that may be quantified, although
the extent of these benefits are more difficult to measure (and, therefore, more difficult to
capture through pricing). Social benefits are the most difficult to quantify, although a
discussion to identify their dimensions would prove invaluable to the future of telemedicine
(and, perhaps, provide a dimension to the discussion not otherwise considered). The social
benefits may require a tax subsidy, if the private pricing is not sufficient to support the cost.

One aspect that has not been discussed previously is: who is capable of providing
telemedicine service—the equipment, the infrastructure, the training? Can private enterprise
do so, generating sufficient revenues to justify the investment? Will it be necessary for
governments, at whatever level, to provide sufficient incentive for its development and
continuation? It all depends on the relationship between benefits and costs, the type of those
benefits and costs, and the extent to which they are private and public. On the other hand,
private enterprise can provide the services with public financing. The advantages and
disadvantages associated with each option needs to be evaluated systematically in future
research.

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EVALUATING TELEMEDICINE:
AN ANALYTIC BIBLIOGRAPHY

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May 24, 1999

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INTRODUCTION

Telecommunications and advanced information technologies have increasingly been used for clinical activities, education, administration, and research to improve health care delivery. Telemedicine was first used in the United States, by NASA, during the 1960s. Since then, its use has increased dramatically, to the estimated clinical usage of 250,000 diagnostic teleradiology studies and 46,200 interactive video and store-and-forward teleconsultations in 1997. With this growth in use, these technologies have been the recipient of many investigations to evaluate their effectiveness and efficiency. These evaluations are extremely important for the future of telemedicine. The impact of telecommunications on the cost, quality, and access issues of the health care industry will determine the extent to which the potential of these technologies is realized. Thus, it is important for telemedicine to be evaluated on a continuing, expansive, appropriate, and comprehensive basis. However, as reported elsewhere, many evaluative investigations have been incomplete or have applied inappropriate techniques in the evaluation process, especially when attempting to evaluate the cost effectiveness of medical technologies.

As a team of evaluation researchers began the task of designing and conducting studies regarding the costs, quality, access, and acceptability of telemedicine implementation in Missouri, the initial step was the collection of information regarding what had been reported previously. This selective bibliography is the result of that activity. This collection of materials will be useful to other researchers in the continuing quest to evaluate the role of telemedicine in today’s health care delivery system.

METHODOLOGY

Before a literature search could begin, it was necessary to agree on a working definition of telemedicine. For purposes of this project, the team accepted the broad definition from the Institute of Medicine, in which telemedicine is defined as: “the use of electronic information and communications technologies to provide and support health care when distance separates the participants.” This broad definition of telemedicine encompasses such activities as: communications through electronic mail (e-mail), internet searches, training in the use of telemedicine resources, remote access to library information, electronic patient records, continuing education through remote attendance of medical grand rounds, remote participation in administrative meetings, transmission of patient data for interpretation and consultation, as well as real time, interactive video patient encounters. This broad definition is consistent with the approach of the Missouri Telemedicine Network (MTN) in implementing and encouraging the use of telemedicine resources in rural Missouri.

This selective bibliography is a collection of materials involving methods of performing evaluation studies and the application of those methods in health care. An effort was made to include materials in the bibliography that are useful, relevant, timely, and readily available to researchers struggling with the complex issues involved in evaluating telemedicine. The

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bibliography is not meant to be an all-inclusive list of publications, but rather is a selective list of
timely and relevant materials applicable to investigating the role of telemedicine in today’s
health care environment.

Once the scope of the search was defined, according to the telemedicine and evaluation
definitions to be used, it was important to identify the sources of bibliographic data and the
keywords to be used in the search. The materials contained in this selective bibliography resulted
from electronic searches on Medline, HealthStar, Cinahl, and ABI using the following key words:

telemedicine
telecommunications
teleradiology
telecardiology
telepathology
teledermatology
cost analysis
benefit-cost analysis
cost-effectiveness analysis
cost minimization
cost utility
utility maximization
multipliers
economic impact
costs
expenditures
economics
burnout
job satisfaction
patient satisfaction
physician satisfaction
nurse satisfaction
provider satisfaction
pharmacoeconomics
outcomes
quality adjusted life year

Once the searches were completed, the titles and abstracts were scanned to determine
if the materials were relevant for the Rural Telemedicine Evaluation Project (RTEP) team. If the
materials were assessed as relevant by team members, then they were included in the
bibliography. In addition, Internet searches were performed on telemedicine, telehealth, and
telecommunications to obtain information on relevant governmental, association, conference,
and consultant reports. Once copies of materials were obtained, the citations referenced in those materials were reviewed for additional sources of information. Authors with multiple publications on the topic were identified, and electronic searches were performed on that author's name to determine if relevant publications had been missed in the original search by topic. In performing the searches, there were no restrictions on dates of the publications or country of origin. The only language restriction was that at least the abstract had to be written or translated into English. This activity resulted in 833 references. Books published on the topic of economic analysis were not included in the bibliography.

Where possible, abstracts were downloaded from other bibliographic databases, such as OVID or MERLIN, and captured into the EndNote database created for this purpose. When possible, the abstract entered was obtained directly from the article; only when abstracts were not available from other sources were articles abstracted by the authors of this bibliography. As mentioned previously, this is a selective bibliography, and is not meant as an all-inclusive source of relevant information. The intent, however, is to provide a systematic reference resource for individuals interested in conducting and reviewing evaluation studies in health care.

Based on several general parameters, the articles were then divided into seven major sections, with materials in each of the sections subdivided into multiple, more closely related categories. These classifications reflect the best assessment of the researchers, and it is very possible, even probable, that other researchers would classify materials differently. Within each category, materials are listed in alphabetical order, by authors. The final section of the report is an alphabetical listing of all materials contained in the document.

SECTIONS AND CATEGORIES

The Methodological Tools section includes materials, general in nature, that explain various evaluation tools. The articles in this section are subdivided into the categories of economic evaluation (benefit-cost analysis, cost-effectiveness analysis, cost-utility analysis,
cost-minimization analysis), general methodology, and outcome and quality measurement. These materials describe various tools for conducting evaluation and the data elements required for their performance, rather than reporting the specific results of their application in a particular study.

The Applications of Methodology section includes materials, general in nature, that report the results from various evaluation investigations. The materials in this section are subdivided into categories reflecting the focus of the evaluation activities. These sub-categories include evaluations involving: cardiology, dermatology, emergency medicine, pharmacoeconomics, case management, satisfaction and burnout, other clinical applications, and other applications.

The General Telemedicine section includes general, background information on telemedicine and telecommunications. The materials in this section are subdivided into the categories of general descriptive studies, critical issues, and policy and regulations. The materials describe the general field of telemedicine and do not, necessarily, report the results of a specific investigation. Many of the telemedicine studies report on non-US systems; however, the methods and results are very applicable to the US health care system.

The Applications to Telemedicine section includes materials reporting the results of evaluation investigations into telemedicine activities. The materials in this section are subdivided into satisfaction and acceptance, outcomes, clinical specialties, and economic evaluation. These materials reflect specific investigations and case studies involving telemedicine and telecommunications.

The Reviews section includes materials that summarize the results of other research, rather than reporting original research findings. The materials in this section are separated into two categories: meta-analysis and reviews. These materials reflect both general evaluation reviews and reviews of studies specific to telemedicine.
The *Editorial* section includes editorials and letters to the editor. While these materials often provide valuable input into an understanding and interpretation of issues, policies, and telemedicine, they do not present systematically derived information on the topic. This section is not subdivided into categories.

The final section, *Other*, is a category containing a collection of miscellaneous materials that provide, relevant, important information, but whose contents did not fall within the other sections created. Example of the types of materials contained here are bibliographies, press releases, and health care industry descriptions. This section, also, is not subdivided into categories.

**RESULTS**

The citations included in this annotated bibliography are arranged alphabetically within seven sections, and subdivided into twenty categories; in instances where the materials are applicable to more than one category, the articles are cross referenced, with the full abstract appearing only in the primary category. The number in parentheses after the category indicates the number of publications listed in the category. These numbers do not sum to the total number of different publications (833) within the bibliography, because of the double counting resulting from the cross-referencing of publications.

- Methodological Tools (316)
  - Economic evaluation (193)
  - General methodology (107)
  - Outcome and quality measurement (21)
- Applications of Methodology (266)
  - Cardiology (11)
  - Dermatology (6)
  - Emergency medicine (34)
  - Pharmacoconomics (16)
  - Case management (7)
  - Satisfaction and burnout (84)
  - Other clinical applications (58)
  - Other applications of methodology (51)
Since this bibliography was originally compiled to assist with the evaluation projects being conducted by the Missouri Rural Telemedicine Project (RTEP), the specific categories identified reflect those projects. Consequently, cardiology, dermatology, and emergency medicine are separated from other clinical studies and pharmacoeconomics is separated from other economic evaluation studies. In addition, materials related to job satisfaction and burnout are included in the applications section, since an area of interest was the impact of telemedicine on health care providers in remote areas.

Examination of the number and content of entries in each section and category provides valuable information regarding evaluation research, and specifically, telemedicine evaluation research studies. The total number of articles placed in the different sections is 841, only eight larger than the total number of articles abstracted. This indicates that most articles are fairly well focused, and that the number of sections is sufficient to capture the majority of the differences across articles. The same is true within each of the sections. Of the eight cross listed articles, five are categorized as dermatology under the Applications of Methodology, and are also listed under the Methodological Tools section.

The number and content of articles listed under each section and category provides valuable information as to where resources have been focused in the past, and, perhaps, to help identify where resources should be focused in the future. There appears to be a need for outcomes and quality measurement tools. With the increasing emphasis being placed on
outcomes, quality, and evidence-based medicine, the need for a consistent, reliable, and robust evaluation tool becomes obvious. Under the section, *Applications of Methodology*, the distribution of articles represents, first, the interest of the RTEP evaluation team, and second, the interest of other researchers. The dearth of case management studies might indicate a need for this type of analysis, especially with the growth of managed care.

There are a total of 161 research studies abstracted in the area of *General Telemedicine* and *Applications to Telemedicine*. The use of telemedicine is increasing around the world, and evaluations will need to be performed and reported, in order to understand and benefit from the potential uses of this technology. There is an obvious shortage of studies focusing on policy and regulation, with only five included in this bibliography. This is unfortunate, indeed, since policies and regulation can ultimately determine the success or failure of telemedicine, regardless of the clinical efficacy, efficiency, and effectiveness.

As materials were read and categorized, a major limitation noted was the absence of a comprehensive economic impact analysis of telemedicine. While various publications provided important components, such as acceptability, accuracy, reliability, cost savings for a specific use, and outcomes, there did not appear to be a single publication that incorporated all necessary aspects of an economic impact analysis. If telemedicine is to reach its full potential, and to be included in public and private third-party financing mechanisms, then clinical efficacy and the costs associated with achieving that efficacy must be demonstrated. Economic analysis can form a framework for evaluating telemedicine systematically.
BIBLIOGRAPHY

Methodological Tools

Economic Evaluations


Development of a quality index allows a quantifiable synthesis of selected patient-care outcomes and service costs. The quality index provides potential buyers of healthcare a way to judge the costs associated with a particular level of quality and thus, compare the value of alternative services. (Abstract by: Author)


Increasingly, economic data are being considered in formulary decisions. In oncology, pharmacoeconomic evaluations are essential to help decision-makers weigh the associated costs and outcomes of competing chemotherapeutic interventions. In this article, we present a four-step pharmacoeconomic research model that can be customized for specific provider or payer systems. The model encompasses problem identification, clinical management analysis, three pharmacoeconomic analyses (cost consequence, expected cost, and cost effectiveness), and a sensitivity analysis--the rank order stability analysis (ROSA)--to validate the findings. (Abstract by: Author)


They suggests that their attempt to apply the basic concepts of the economics discipline to a real world of decision-making in the face of scarce resources is worlds apart from the Johannesson and Weinstein world of 'pick an assumption, any assumption.' They consider the decision rules proposed by JW, and go on to demonstrate that the JW critiques are flawed, resting, as they do, on precisely those assumptions that they set out to relax.


There is an increasing tendency for papers appearing in the medical literature to propose or use league tables of cost-effectiveness ratios as a means of comparing health-care interventions. In this paper we identify what the information in cost-effectiveness league tables tells us and how this is inadequate and inappropriate for addressing questions about improving efficiency in the use of resources at either the broad system level or at the individual care-group level. We present an alternative approach, which provides decision-makers with a practical way of deciding whether the adoption of a particular program represents an unambiguous improvement in economic efficiency. (Abstract by: Author).


Establishing the value of a new medicine by applying the tools and methods of pharmacoeconomics has become an important third objective in many clinical trials. The pharmacoeconomic investigator conducting research in clinical trials must understand and
conform to the rules and procedures governing the clinical trial process. This article addresses some of the vital yet often overlooked details associated with conducting pharmacoeconomic research in clinical trials. The protocol, the informed consent form, the data collection instruments, the study initiation, and the final study report are all discussed. Additionally, limitations of the study results are reviewed. (Abstract by: Author)


The choice of numeraire is shown to be important in cost-benefit analysis. When a public good is involved, individual consumers' marginal rates of substitution will generally differ.


The aim of this paper is to briefly outline a Bayesian approach to cost-effectiveness analysis. The potential overlap between Bayesian and frequentist approaches to cost-effectiveness is explored. Although it is argued that the interpretation as the probability that an intervention is cost-effective given the data requires a Bayesian interpretation, this should generate no misgivings for the frequentist.


This article makes two primary claims. First, if an attempt is to be made to fix a monetary value on life, it is wrong to do so on the basis of people's evaluations of probabilities of death. Second, because the monetary compensation required for loss of life is infinite, cost-benefit analysis will be inapplicable for judging any proposal involving deaths. The author offers several formulas using utility, change in personal welfare, and marginal utility of money per unit change as variables.


In this response we concentrate on what Weinstein et al. call the 'major disagreement' between the Erasmus group and the US Panel, which concerns the measurement of productivity losses during illness. We consider the consequences for the individual, for the employer and for the rest of society and argue that when following the Panel's propositions for measuring these consequences, major theoretical and practical difficulties are encountered. (Abstract by: Author)


Cost containment is the key issue in healthcare systems and a key concept that nurses must grasp in this time of shrinking budgets and growing demand for health care. As healthcare budgets come under increasing scrutiny, nurses must prove their cost-effectiveness. To ensure the maintenance of quality care, national nurses' associations have a strong role to play in supporting research efforts into nursing's real worth (not only in cost terms) and gathering and disseminating this information to demonstrate the value of quality nursing. To get nurses worldwide to campaign for cost-effectiveness, ICN will focus on "Quality, Costs and Nursing" in its celebration of International Nurses' Day in 1993. (Abstract by: Author)


Buchanan and Faith suggest that the valuation of life, regardless of the methodology, is only necessary when a choice is confronted and opportunity costs are meaningful. Broome's (1978) valuation of life is examined using the presumed objectivity of cost and the Pareto
criterion for social improvement. In a supplemental article, Jones-Lee revisits and offers counter arguments for Broome's (1978) cost-benefit analysis of risk-change.


The role of modeling in economic evaluation is explored by discussing, with examples, the uses of models. The expanded use of pragmatic clinical trials as an alternative to models is discussed. Some suggestions for good modeling practice are made.


The principle of extended dominance is applied in incremental cost-effectiveness analysis to eliminate from consideration strategies whose costs and benefits are improved by a mixed strategy of two other alternatives. Ethical considerations arise, however, in that equal care is not provided to all of the population. To explore these concerns, the authors establish a theoretical health care example with three diagnostic strategies. They demonstrate, both algebraically and geometrically, how to calculate the set of all possible mixed strategies that dominate the strategy eliminated by extended dominance. With the consideration of budget constraints, they define the "coefficient of inequity" as the minimum proportion of the population that would receive an inferior health care strategy if a mixed strategy were to be used instead of the dominant strategy. The implications of cost-effectiveness analysis are made explicit, revealing classic economic concerns about the tradeoff of equity and efficiency.


Health care has become increasingly expensive and clinicians have come under increased scrutiny to appraise critically the economic impact of medical programs and interventions. To ensure an equitable allocation of scarce resources and the attainment of maximal clinical benefit, it is vital to adhere to certain basic tenets of economic analysis and to understand the basic approach to cost-effectiveness analysis. These principles are applied to critical care medicine and analogies are made to the methodological rigor of evidence-based medicine. (Abstract by: Author)


Cost-effectiveness ratios usually appear as point estimates without confidence intervals, since the numerator and denominator are both stochastic and one cannot estimate the variance of the estimator exactly. The recent literature, however, stresses the importance of presenting confidence intervals for cost-effectiveness ratios in the analysis of health care programs. This paper compares the use of several methods to obtain confidence intervals for the cost-effectiveness of a randomized intervention to increase the use of Medicaid's Early and Periodic Screening, Diagnosis and Treatment (EPSDT) program. Comparisons of the intervals show that methods that account for skewness in the distribution of the ratio estimator may be substantially preferable in practice to methods that assume the cost-effectiveness ratio estimator is normally distributed. We show that non-parametric bootstrap methods that are mathematically less complex but computationally more rigorous result in confidence intervals that are similar to the intervals from a parametric method that adjusts for skewness in the distribution of the ratio. The analyses also show that the modest sample sizes needed to detect statistically significant effects in a randomized trial may result in confidence intervals for
estimates of cost-effectiveness that are much wider than the boundaries obtained from deterministic sensitivity analyses.


Managed care pharmacy organizations have the responsibility to promote high-quality cost-effective health care that provides value to their enrolled populations. Application of management interventions that reduce the inappropriate use of medications and enhance the appropriate use of medications and that improve patient outcomes and the cost effectiveness of care can help meet these responsibilities. To accomplish these management objectives, managed care pharmacy organizations should aggressively apply the results of pharmacoeconomic studies and, where possible, participate in the conduct of these studies. (Abstract by: Author)


Cost-utility analysis (CUA) was developed to guide the allocation of health care resources under a budget constraint. As the generally stated goal of CUA is to maximize aggregate health benefits, the philosophical underpinning of this method is classic utilitarianism. Utilitarianism has been criticized as a basis for social choice, because of its emphasis on the net sum of benefits without regard to the distribution of benefits. For example, it has been argued that absolute priority should be given to the worst off when making social choices affecting basic needs. Application of classic utilitarianism requires use of strength-of-preference utilities, assessed under conditions of certainty, to assign quality-adjustment factors to intermediate health states. The two methods commonly used to measure strength-of-preference utility, categorical scaling and time tradeoff, produce rankings that systematically give priority to those who are better off. Alternatively, von Neumann-Morgenstern utilities, assessed under conditions of uncertainty, could be used to assign values to intermediate health states. The theoretical basis for this would be Harsanyi's proposal that social choice be made under the hypothetical assumption that one had an equal chance of being anyone in society. If this proposal is accepted, as well as the expected-utility axioms applied to both individual choice and social choice, the preferred societal arrangement is that with the highest expected von Neumann-Morgenstern utility. In the presence of risk aversion, this will give some priority to the worst-off relative to classic utilitarianism. Another approach is to raise the values obtained by time-tradeoff assessments to a power $a$ between 0 and 1. This would explicitly give priority to the worst off, with the degree of priority increasing as $a$ decreases. Results could be presented over a range of $a$. The results of CUA would then provide useful information to those holding a range of philosophical points of view. (Abstract by: Author)


This article outlines basic principles for the economic analysis of clinical decisions. Using a hypothetical scenario involving a patient with low back pain, the specific application of cost-benefit analysis (CBA) and cost-effectiveness analysis (CEA) is illustrated; and the two methodologies are compared. Cost-benefit analysis is advanced in the "gold standard" among the two approaches because it forces decision-makers to explicitly value both the cost and health consequences of alternative clinical actions.

General practitioners, especially fund holders, are becoming increasingly concerned about being asked to prescribe treatments for their patients that are outside their therapeutic experience. They are concerned about the clinical responsibility for such prescribing and the effects on their budgets. In some specialties transferring the costs of expensive treatments from secondary to primary care (cost shifting) has become partly institutionalized because of the separate sources of funding for drugs prescribed in the two sectors. With increased efforts to control the rising costs of the drug budget and the emergence of new expensive treatments, cost shifting will be a challenge to clinicians and purchasers as they strive for rational, cost effective prescribing. A review of the funding mechanisms for drugs prescribing and of the relation between the licensing process and the decision to support the use of a treatment in primary or secondary care is needed.


Perspectives in an economic analysis of medical technology reflect who makes decisions about the use of or payment for medical resources. Commonly used perspectives include those of providers, insurers, the individual, and society. Perspective is a critical determinant of study design, affecting the time horizon, types of resources considered, and economic cost measures assigned to those resources. Individuals involved in technology assessment for either research or policy-making purposes should be aware of the complexities of defining costs from different perspectives. (Abstract by: Author)


The use of economic evaluation to assess the costs and consequences of health care technologies has steadily increased in recent years. However, little is known about the influence economic studies have on health care decision makers or policy at local and national level. This paper reports the results of a survey of economic evaluations in EC countries to identify the impact of the results on decision and policy making in health care. Health service researchers in 10 EC countries were identified and asked to participate in the survey. The researchers were asked to locate economic evaluations in their country and complete a standardized questionnaire for each study. The criteria for inclusion in the survey were first, the studies should have been started or reported since 1987, second, the evaluations should include a comparison of the cost and consequences of the technologies assessed and finally, the appraisals should include a comparison of alternative health care technologies or programs. A total of 66 studies, which met the survey criteria, were reported. Of these, 27% were thought to have influenced health care decision-makers or policy. The results suggested that method of dissemination, source of funding and purpose of the study may be important determinants of whether an economic evaluation will be used in health care policy or decision making. The results of the survey suggest that economic evaluation currently has a relatively low impact on health care policy or decision making. If researchers wish to increase the influence of economic evaluation in the policy process more attention needs to be paid to (i) methods of communicating the results to health care decision and policy makers, and (ii) the policy making framework and process.

The literature on economic evaluation of pharmaceuticals is growing rapidly. Although there have been substantial methodological advances, there remain serious problems and pitfalls. This presentation focuses on three aspects, i.e., use (and abuse) of evaluation studies, methodological problems, and the quality of published studies. (Abstract by: Author)


OBJECTIVE: To demonstrate the difficulty of estimating cost effectiveness of alternative implementation strategies using clinical trial data. DESIGN: Two examples drawn from a hearing-aid intervention trial and a physical-therapy trial for frail elderly are used to demonstrate how alternative implementation strategies may affect cost effectiveness. Sensitivity analysis is used to document a range of possible economic outcomes for each example and show how assumptions based on trials may bias implementation decisions. MAIN OUTCOME MEASURES: Costs and cost-effectiveness ratios are estimated for alternative implementation strategies and compared with trial results. MAIN RESULTS: Staffing and equipment substitutions, reconfigurations, and economies of scale can reduce the cost of trial interventions substantially. Such resource alterations as well as protocol and target group modifications may also have an impact on effectiveness. In both examples effectiveness can be reduced by as much as 50% and under certain conditions alternative implementation strategies will still be cost effective. CONCLUSIONS: Cost effectiveness of implementations can differ substantially from a trial, when different resources or target populations are incorporated. Institutions must conduct preimplementation studies, which consider alternative resource configurations before adopting an intervention based on trial results. (Abstract by: Author)


This article presents a series of conceptual guidelines to help the researcher measure costs of medical treatment. The fundamental concept of opportunity cost is introduced first. This concept is essential to understanding the importance of perspective, which is discussed in the next section. These points are then used to show how the analyst can determine which costs should be included in the analysis. Additional conceptual topics in cost measurement, including the distinction between fixed and sunk cost, learning effects, and the importance of duration of the study period are covered. Finally, practical guidance for estimating costs is provided. (Abstract by author)


This paper uses semi-parametric methods to estimate the magnitude of economies of scale in 14 non-revenue producing cost centers in hospitals. There are substantial economies of scale in small hospitals, but economies are exhausted in hospitals with over 10,000 discharges annually. In recent hospital mergers challenged by federal antitrust agencies, one or both hospitals had over 10,000 discharges, suggesting that efficiency gains in non-revenue producing cost centers will be small, and could easily be offset by nominal price increases. (Abstract by: Author)

Controlled clinical trials are recognized as the best source of data on the efficacy of health care interventions. Because economic evaluation is dependent on the quality of the underlying medical evidence, clinical trials have increasingly been viewed as the natural vehicle for economic analysis. However, the closer integration of economic and clinical research raises many methodological issues. This paper discusses these issues in trial design, collection of resource use and outcome data, and the interpretation of results. Suggestions are made for resolving the major problems.


Economic evaluations of health care programs and treatments have now been conducted for about 30 years. A number of key methodological principles have been specified and there has been an exponential rise in the number of published studies. However, there is relatively little evidence of the use of these studies in decision making about health technologies. Therefore, this paper considers what policy issues are amenable to economic analysis, or could be greatly informed by economic appraisal results. It is concluded that a wide range of mechanisms exist to influence the diffusion and use of health technologies and that economic appraisal is potentially applicable to a number of them. The paper also considers how economic appraisal could be made more relevant to decision making. It is concluded that methodological standards need to be maintained, that evidence needs to be produced in a timely fashion, that the local validity of study results needs to be increased, that the dissemination of study results needs to be improved, and that more note needs to be taken of the available policy instruments.


This paper explores how the data contained in economic evaluations could be useful to those involved in medical audit or the development of clinical guidelines.


There has been an exponential growth in the literature on economic evaluation in health care. As the range and quality of analytical work has improved, economic studies are becoming more influential with health care decision-makers. The development of standards for economic evaluation methods would help maintain the scientific quality of studies, facilitate the comparison of economic evaluation results for different health care interventions, and assist in the interpretation of results from setting to setting. However, standardization might unnecessarily stifle methodological developments. This paper reviews the arguments for and against standardization, assesses attempts to date, outlines the main areas of agreement and disagreement on methods for economic evaluation, and makes recommendations for further work. (Abstract by: Author)


The assessment of economic and quality-of-life outcomes of health care interventions is moving into a new era, with such assessments increasingly being made within the context of controlled clinical trials. Traditionally the measurement of many variables in economic evaluations, particularly costs, has been deterministic. In the context of clinical trials the
measurement of variables is stochastic, with the standard principles of statistical inference being applied to analyze differences between treatments in terms of effectiveness. Economists participating in clinical research are therefore being called upon to specify the sample size for the economic component of the evaluation and to undertake statistical tests for differences in cost or cost-effectiveness. This paper discusses the current methodological issues surrounding stochastic measurement in clinical trials, discusses the additional issues raised by the assessment of economic and quality-of-life outcomes and specifies the challenges facing economists if they are to answer the questions now being posed about economic analysis by statisticians and clinical researchers. It is concluded that application of the standard principles of statistical inference to economic data is not straightforward and will require value judgements to be made about statistical significance and economic importance, which may differ from those already made in purely clinical studies.


Practical issues surrounding the incorporation of economic analysis in clinical trials were examined by considering potential studies in the six major clinical areas. In each case a scenario was presented whereby a clinical trial was planned and five key issues were explained. The working groups' discussion explored in a more practical way, some of the issues raised in the plenary session. The general view was that it was worthwhile to include economic evaluation alongside many clinical trials, but that the practical and methodological issues needed careful consideration. (Abstract by: Author)


Economic issues have had a growing importance in the health care field as the sector's share of the gross national product has risen. Clinicians are under increasing pressure to adopt more cost-effective treatment practices, as a result of initiatives being taken by the major third-party payers, government, and business. However, recent publications suggest that there are some misconceptions about economics in health care and the extent to which it is in conflict with good clinical practice. To provide a foundation for the understanding of this field by clinicians, we have outlined several basic notions of health economics.


In recent years, it has become fashionable to make comparisons (in 'league tables' or rankings) between health care interventions in terms of their relative cost-effectiveness, in cost per life-year or cost per quality-adjusted life-year gained. However, concerns have been raised about the unthinking use of league tables and some authors have questioned the theoretical basis of their construction. In this paper a recently reported league table is scrutinized and the important methodological features of the source studies identified. These include the choice of discount rate, the method of estimating utility values for health states, the range of costs and consequences considered and the choice of comparison programme. Several recommendations are made for improvements, both in the methodology of economic evaluation studies and in the construction and use of league tables. It is concluded that, for league tables to be useful, decision-makers should be able to assess the relevance and reliability of the evidence in their own setting. Fuller reporting of methods and results by the authors of economic evaluation studies would greatly assist in the appropriate construction and use of league tables. (Abstract by: Author)

This article describes the various parties with a stake in guidelines for the provision of economic data, reviews the purposes served by such guidelines and suggests ways forward. (Abstract by: Author)


This paper discusses the relevance of quality of life measurement in clinical and epidemiological research to resource allocation decisions in health care. The discussion concentrates on economic evaluations, the form of health services research which most directly pertains to decisions about the allocation of resources, and the use of the quality-adjusted life-year in economic evaluation. Three key issues are addressed: whose assessments of quality of life are relevant and how should these be obtained; should one search for a generalizable quality of life measure; is it right to construct "league tables" of health care interventions in terms of cost per quality-adjusted life-year?


In the context of new challenges, issues facing the science, practice, and future of pharmacoeconomics will be discussed. Certain methodological weaknesses have been observed in published pharmacoeconomic studies, and compromises need to be made between developing an "ideal" method and allowing a study to remain practicable. The objective is to reach a balance between clinical trial-based studies and projective models; trials have high internal validity but low external validity, while models can help explore relevance to real-life settings. Cross-national differences also have an important impact on pharmacoeconomic data; however, using some basic standardized guidelines results from pharmacoeconomic studies may be generalized to other settings. The use of pharmacoeconomic results by decision-makers in the United Kingdom has been restrained by unclear priorities within their authority and by the limited availability of credible studies. The future of pharmacoeconomics lies in developing both trial-based and modeling studies, improving their credibility, and meeting the needs of decisionmakers. (Abstract by: Author)


Controlled clinical trials are recognized as the best source of data on the efficacy of health care interventions and technologies. Because economic evaluation is dependent on the quality of the underlying medical evidence, clinical trials have increasingly been viewed as a natural vehicle for economic analysis. However, the closer integration of economic and clinical research raises many methodological issues. This paper discusses these issues in trial design, collection of resource use data, collection of outcome data, and interpretation and extrapolation of results. Some guidelines are suggested for economic analysts wishing to undertake evaluations alongside clinical trials.


Economic evaluations of interventions to lower blood pressure or cholesterol have used different outcome measures, or end points, in the denominator. Some have related the costs of interventions to improvements in physiologic end points such as mm Hg reduction in blood pressure. Some have related costs to avoidance of coronary heart disease (CHD) events or
gains in life expectancy. Others have measured improvements in outcome in quality-adjusted life years (QALYs) gained. The different end points imply different analytic perspectives and different data requirements. The more ambitious analyses, though potentially more relevant in certain situations, require more controversial assumptions to be made. This paper illustrates the trade-offs of relevance, accuracy, and precision by reference to an evaluation of drug therapy for hypercholesterolemia undertaken in the United Kingdom. Estimates are given of cost per percentage cholesterol reduction, cost per CHD event avoided, cost per CHD-free year gained, cost per life year gained, and cost per quality-adjusted life year gained. In each case the assumptions required and the potential relevance of the estimate are discussed. The main findings are that: 1) some end points cannot be discounted to present values in a meaningful way and hence the timing of costs and outcomes cannot be reflected in the analysis; 2) the incorporation of quality-of-life adjustments for years on drug therapy and years post-CHD events greatly changes the cost-effectiveness ratios; 3) the rate of discount changes the pretreatment level of cholesterol for which cost per life year gained is equivalent to cost per quality-adjusted life year gained. (Abstract by: Author)


Due to the growing number of studies in the economic evaluation of health care, the BMJ set up a working party an economic evaluation to improve the quality of submitted and published articles. This article contains the basic guidelines to follow when writing a report on the economic evaluation of health care.


See Mooney G.H.


See Mooney G.H.


In a market system institutions such as hospitals and insurance companies are unlikely to be indifferent to the nature or amount of care provided, even if operating along non-profit lines. Strategies designed to increase the efficiency of provision, therefore, need to take these interests into account.


The choice of method of financing health care is primarily an ideological one and will always remain so; but the study of financing systems from an economic viewpoint yields important insights, which can be used to improve the efficiency of delivery of health care, whatever the system.


See Mooney G.H.

See Mooney G.H.


See Mooney G.H.


This article assesses the cost and benefits of treatment alternatives. It is summated in the second article in this series.


The mechanisms for building cost-benefit thinking into individual clinical actions are not well developed. Many clinicians are not aware of these notions, however, and more information about the implied costs of alternative clinical actions might result in a change in practice if the appropriate mechanisms for bringing about such changes existed.


This article investigates the challenges for the future of health economics. It is summated in the second article in this series.


The biggest challenge to economists is to try and gain wider acceptance by doctors and other professionals of the ideas put forward in this series. Perhaps, the biggest challenge is one it has always faced since it was founded--to ensure, within the resources available and within some commonly agreed view of fairness, as healthy a population as possible.


Given the increasing interest in the economics of health care, the incorporation of economic analysis in clinical trials is more often being considered, both by medical researchers and by research funding bodies. This article proposes criteria for judging the appropriateness of including economic analysis in a given trial, suggests how that analysis could be phased in order to minimize the work involved, and discusses the wider implications for medical research of more frequent attention to economic concepts.


This article presents a dialogue between the author and M.H. Eddy about issues concerned with clinical decision-making.

This article presents a dialogue between the author and M.H. Eddy about issues concerned with clinical decision-making.


This article presents a dialogue between the author and D.M. Eddy about issues concerned with clinical decision-making.


In a pharmacoeconomic analysis, the validity of findings is critical because product ranking may influence formulary decision making. The authors present an approach for examining uncertainty in a pharmacoeconomic analysis that parallels the confidence-interval approach to statistical analysis. This method, rank-order stability analysis (ROSA), is a clear and comprehensive method for validating results of a pharmacoeconomic analysis, as it identifies and evaluates all inputs and values. It is a break-even analysis that identifies the specific point of insensitivity for all parameters analyzed in the pharmacoeconomic model. ROSA is proposed as the preferred method for judging the validity of results derived from estimated parameters in pharmacoeconomic analyses. (Abstract by: Author)


The article explores various economic analyses, including cost-identification, cost-effectiveness, and cost-benefit. The author also reviews the perspectives of analyses and determinants of cost as a function of each type of economic analysis. Comparisons of options in medical practices that rely on several cost analyses may help clinicians achieve the societal goal of achieving the greatest benefit for the most people, thus maximizing the utility of medical care for the resources used.


Clinicians need to be familiar with the core methodology of cost-effectiveness economic analysis, as this information will increasingly be used in clinical decision-making. Just as in clinical trials, there are rules to be followed, and many pitfalls for the novice. (Abstract by: Author)


Clinical trial randomization schemes to control patient characteristics that can influence clinical response are not sufficient to control for their effects on operational efficiency and cost within the provider institution. This variation can result in biased economic findings when patients are allowed to select a provider themselves. (Abstract by: Author)


Discusses the topic of the inclusion of health-economics assessment in randomized clinical trials (RCTs). They found that RCT is not the best place for detailed assessment of
individual-patient economic costs, and that most trials should only collect minimal data enabling the broadest of cost indications to be reported.


Four years ago it became obvious within the US Department of Defense (DOD) that expenditures for pharmaceuticals and health care were escalating beyond control. Realizing this upward pressure on costs was one of the major trends jeopardizing the military health care system, which cares for 8 million-plus beneficiaries, the DOD began using pharmacoeconomics to manage pharmacy expenditures. The DOD has several competing goals: to reduce pharmaceutical expenditures within the context of an open formulary while maintaining optimum patient care; provide practitioners, pharmacists, and administrators with the information they need to make cost-effective choices in pharmacotherapy; and provide for a consistent and equitable pharmacy benefit throughout the DOD based on cost-effective recommendations. Currently used methods for pharmacoeconomics did not meet the DOD's needs, so it turned to applied pharmacoeconomics. This paper discusses the use of applied pharmacoeconomics as it pertains to the DOD. (Abstract by: Author)


Data Envelopment Analysis (DEA) identifies price and technical inefficiencies among decision-making units. With controls for differences in case-mix and standardized outcomes, DEA's "best practice" frontier can be interpreted as a "cost-effectiveness" frontier. This study illustrates the key concepts, identifies the decisions required to use th technique for medical care decision making, and presents an application to a system of nine hospitals that offer obstetric services.


Objective: This review builds on the innovative research synthesis of Holder and his colleagues, addresses some of the limitations of the box-score approach to assessing treatment effectiveness that they used and provides a second approximation of the cost-effectiveness of treatment for alcoholism. Method: For each of the 141 comparative treatment studies, we determined whether or not it found at least one statistically significant positive effect on a drinking-related outcome variable for each of the modalities examined in a paired contrast with one other condition. We next calculated the predicted probability of each study yielding at least one statistically significant treatment effect, based on the number of tests for treatment effects conducted. Following that, for each study of a particular treatment modality, the strength of the "weakest competitor" against which the modality had been compared was determined. For each modality, we used the average predicted probability of the relevant studies finding a significant effect and the average effectiveness of the weakest competitor to predict the modality's effectiveness. Results: We calculated an Adjusted Effectiveness Index (AEIn) for each modality, which was the difference between its predicted and actual effectiveness score. Our AEIn results were consistent with those of Holder et al. in suggesting that some of the same modalities appear to be effective or ineffective. Our results differed from their findings with respect to other modalities, however. Using data presented by Holder and his colleagues on the minimum estimated cost of providing different modalities, we offer a second approximation of the modalities' cost-effectiveness. Conclusions: Overall, we found a smaller range of effectiveness across modalities than did Holder and his colleagues and a non-significant relationship between cost and effectiveness. Like Holder et al., we do not believe major treatment provision or funding decisions should be based solely on this type of review.

Primary finding: economic analyses are concerned with the costs and benefits of health care interventions in the real-world setting and are likely to be more helpful when undertaken as part of a large, unblinded, pragmatically designed, randomized trials based as closely on regular clinical practice.


Economic analyses have become increasingly important in healthcare in general and with respect to pharmaceuticals in particular. If economic analyses are to play an important and useful role in the allocation of scarce healthcare resources, then such analyses must be performed properly and with care. This article outlines some of the basic principles of pharmacoeconomic analysis. Every analysis should have an explicitly stated perspective, which, unless otherwise justified, should be a societal perspective. Cost minimization, cost-effectiveness, cost-utility, and cost-benefit analyses are a family of techniques used in economic analyses. Cost minimization analysis is appropriate when alternative therapies have identical outcomes, but differ in costs. Cost-effectiveness analysis is appropriate when alternative therapies differ in clinical effectiveness but can be examined from the same dimension of health outcome. Cost-utility analysis can be used when alternative therapies may be examined using multiple dimensions of health outcome, such as morbidity and mortality. Cost-benefit analysis requires the benefits of therapy to be described in monetary units and is not usually the technique of choice. The technique used in an analysis should be described and explicitly defended according to the problem being examined. For each technique, the method of determining costs is the same; direct, indirect, and intangible costs can be considered. The specific costs to be used depend on the analytical perspective; a societal perspective implies the use of both direct and indirect economic costs. A modeling framework such as a decision tree, influence diagram, Markov chain, or network simulation must be used to structure the analysis explicitly. Regardless of the choice of framework, all modeling assumptions should be described. The mechanism of data collection for model inputs must be detailed and defended. Models must undergo careful verification and validation procedures. Following baseline analysis of the model, further analyses should examine the role of uncertainty in model assumptions and data. (Abstract by: Author)


It addresses whether flaws in the economic methods themselves or the oversimplification and misapplication of these methods are responsible for the perceived lack of usefulness of cost-benefit analyses with in the health care system.


In this paper, we critically appraise the appropriateness and validity from an economic perspective of alternative preference-based approaches to measuring outcomes in economic evaluations of health care interventions. We describe the properties of an outcome measure for economic evaluation to make it compatible with the principles of economics when applied to the problem of resource allocation. We also describe the difference and similarities between the psychometric and the economic approaches for the measurement of outcome. Using these properties we critically appraise the use of QALY and HYE methods of measuring individual and
social preferences for health outcome. We argue that the most advanced measure currently available that meets these required properties is the HYE. Because the HYE, unlike the QALY, has its foundations in utility theory under certainty, it neither assumes particular formulations of the individual utility function, nor is it compatible with the principles of economics. As such it represents a further stage in the continuing development of methods for economic evaluation of health care programs.


Cost-effectiveness analysis is increasingly recognized as an important element for health policy formulation. Family physicians will be affected by these analyses, for they will influence the manner and type of care we deliver. The principles of cost effectiveness research (the focus of this paper) are straightforward and offer primary care clinicians the opportunity to become more involved in the policies that affect their practice.


The recent article by Redelmeier and Heller and the accompanying commentary by Weinstein emphasize the importance of continuing to evaluate medical decision making's basic premises. This author contends that several misconceptions continue to cloud this issue, among which are:
1. gambling=discounting
2. discounting=discounting
3. health=wealth
4. policy=policy


Cost-effectiveness is an integral part of health care policy, influencing both medical and administrative decisions. However, current research methodology for evaluating cost-effectiveness produces several paradoxes, perhaps because it incorrectly represents the general population’s view of future health states. Recent work introduces clinical and demographic factors to the traditional cost-benefit model for discounting health outcomes. It suggests a revised model that provides a more accurate basis for health policy decision-making. This revised model will likely improve the apparent cost-effectiveness of prevention programs, which are at a distinct disadvantage in present models. This article presents examples of current paradoxes resulting from the standard discounting methodology, findings on the variability of health outcomes discount rates in patients, and preliminary thoughts on developing a revised model for discounting future health outcomes. This revised model should present the value of health promotion programs more accurately. (Abstract by: Author)


To address controversies in the applications of cost-effectiveness analysis, we investigate the principles underlying the technique and discuss the implications for the evaluation of medical interventions. Using a standard von Neumann-Morgenstern utility framework, we show how a cost-effectiveness criterion can be derived to guide resource allocation decisions, and how it varies with age, gender, income level, and risk aversion. Although cost-effectiveness analysis can be a useful and powerful tool for resource allocation decisions, a uniform cost-effectiveness criterion that is applied to a heterogeneous population level is unlikely to yield Pareto-optimal resource allocations. (Abstract by: Author)

The problem of variability in computed cost-effectiveness ratios (CERs) is usually addressed by performing sensitivity analyses to determine the effects on these ratios of plausible ranges of values of input parameters. However, the sampling variation that exists in these estimated parameters can be utilized to obtain confidence intervals for cost-effectiveness ratios. As cost-effectiveness analysis becomes more widely used, new techniques need to be developed for establishing when a difference in strategies evaluated is meaningful. A first step is to establish the precision of the CER itself. The authors estimate the precision of a CER in the context of a statistical model in which the primary outcome is survival, with cost and effectiveness defined in terms of the underlying survival distribution. Effectiveness is measured by life expectancy, restricted to a finite time horizon and discounted at a fixed rate. Cumulative cost per patient is regarded as resource utilization and incurred randomly over time, depending on the survival experience of the patient. The technique is applied to survival data from 218 previously studied patients to assess 95% confidence intervals for the CER and average cost-effectiveness (ACE) of the implantable cardioverter defibrillator as compared with electrophysiology-guided therapy.


This article provides a brief review of the Panel's mission and activities.


OBJECTIVES: The authors developed an “off-the-shelf” source of health-related quality of life (HRQL) scores for cost-effectiveness analysts unable to collect primary data. METHODS: The authors derived and conducted preliminary validation on a set of health-related quality of life scores for chronic conditions using nationally representative data from the National Health Interview Survey (NHIS) and the Healthy People 2000 Years of Healthy Life measure developed to monitor the health (longevity and health-related quality of life) of Americans during this decade. The measure comprises two domains, role function and self-rated health, and is scaled from 0 (death) to 1 (best health state). Health-related quality of life scores for chronic conditions were calculated using the Years of Healthy Life scores associated with chronic conditions reported in the 1987-1992 National Health Interview Survey. Preliminary validation was examined by comparing the health-related quality of life scores with those obtained in two other studies. RESULTS: Tables provide health-related quality of life scores for persons with and without conditions. The scores had reasonable face validity, ranging from 0.87 for allergic rhinitis to 0.27 for hemiplegia. Correlations of the health-related quality of life condition weight scores with those from two other studies were 0.78 and 0.86. CONCLUSIONS: These condition weights may prove useful to investigators conducting cost-effectiveness analyses using secondary data, where community ratings of health-related quality of life for chronic conditions are required. Use of a standard set of health-related quality of life weights gathered from a national sample can enhance the comparability of cost-effectiveness analyses. Improvements in national data collection techniques, with empirical gathering of preferences, will further strengthen this measure. (Abstract by: Author)


In this paper, cost and effectiveness data for six clinical interventions are applied simultaneously to a hypothetical population of 100,000 patients to show how selecting guidelines to maximize overall population benefit compares with selecting the best guidelines for
individual patients. By entering effectiveness (added survival) and cost information from recent prevention, screening, diagnostic, and therapeutic guidelines into a computer-based optimization model, the options that maximized overall population effectiveness while keeping additional cost within varying specified constraints were identified. In 57% of selection opportunities, the clusters of guidelines that yielded maximum population benefit differed from those that maximized benefit for individual patients. Some choices were more stable than others over ranges of cost constraints. Clinical practice guidelines chosen to maximize cost-effectiveness for individual patients often do not maximize cost-effectiveness for populations of patients. To allocate resources as efficiently as possible, decision makers should consider other sources of information in addition to the recommendations of specific practice guidelines. “Robust” guidelines that simultaneously address both individual and societal health benefits should be sought.


This is the eighth in a series of 10 articles introducing non-experts to finding medical articles and assessing their value. Conclusions: an economic analysis should be based on a primary study or meta-analysis that is scientifically valid, reliable, and relevant. When deciding whether an economic analysis has been done correctly, you should not simply check the arithmetic but consider whether all direct, indirect, and intangible costs and benefits have been included. In the allocation of limited resources, the comparison of different health states is unavoidable, but instruments for measuring health-related quality of life are not as objective as they seem. (Abstract by Author)


The health care system is routinely confronted with promising new technologies. In the past, most new technologies have been integrated into clinical practice without a rigorous demonstration of their effectiveness or efficiency. In order to provide a more rational approach to the adoption and utilization of health technology a comprehensive set of guidelines for both clinical and economic evaluation is proposed. While conceived of as an ideal that is unlikely to be universally met in practice, it is argued that decision making can be improved by striving towards this goal. The clinical guidelines stress the advantages of subjecting major new technologies to randomized controlled trials and insisting upon a demonstration of patient benefit in the application of diagnostic technologies. The economic guidelines stress comparisons with relevant alternative uses of the resources and the assessment of the impact on the quality of life. While application of the guidelines will produce rigorous and useful evidence, the final decisions concerning the allocation of health care resources must rest fundamentally on social value judgements and not solely, or even primarily, on informed expert opinion.


They present an approach to conducting one type of PE evaluation, the cost-effective analysis, which incorporates the input of institutional providers with patient effectiveness data. They apply this approach to an evaluation of lipid-lowering agents, but the approach can be adapted to in this or any therapeutic category. A brief overview of cost-effective analysis is provided.
When using cost-effectiveness analyses to prioritize the allocation of health care resources across patients, a standard definition of effectiveness must be used. In an informal review of cost-effectiveness analyses, we found a heterogeneity in the methods used to qualify adjust years of life. Many studies do not account for the morbidity conditions that patients experience other than the index condition being studied. These studies systematically overstate health benefit relative to studies that do for comorbidities. We recommend that patient preferences for comorbid conditions be incorporated into analyses to allow a consistent and facile comparison of cost-utility ratios for societal decision making. (Abstract by: Author)

To identify the significant inputs, activities, and outputs of a regional poison control center, a production model is described and its potential application to the conduct of economic evaluations delineated. The model can help the researcher identify the significant inputs (costs) incurred through the provision of poison control center services. These inputs directly influence the activities that the poison center is capable of undertaking. Activities undertaken by a poison center are intermediate steps between the inputs and outputs, and serve to convert the various inputs into associated outputs. They form the basis for determining the outputs produced by the poison center services. The outputs derived from poison center services provide the conceptual framework for assessing the effectiveness of a poison center in an economic analysis. Also described are potential applications of the production model in conducting poison center cost-effectiveness and cost-benefit analyses.

With many community field trials or education interventions, the cost-effectiveness analyses are not given a high priority. However, this type of evaluation is important for purposes of future adoption of the intervention. The accurate measurement of costs can best be served by prospective collection of data. This article describes a methodology for collection of cost data that coincides with the intervention implementation. This cost analysis strategy has seven discrete steps. The Minimal Contact Education for Cholesterol Change study is used as an example of the use of this strategy. This intervention provides cholesterol education at six different levels of intensity at four different sectors. The intensity levels vary along a continuum from very little education input to a maximum level of intervention that might be practical in a screening setting. The cost-effectiveness analysis component of the study will identify the incremental cost-effectiveness of each intervention along the continuum. (Abstract by: Author)

Payers are increasingly interested in knowing whether they are receiving value for the dollars they spend on health care. Because economic analysis will be used as a means of evaluating radiation therapy, it is important that radiation oncologists understand the basic methodology employed in such analyses. This review article describes the four basic types of economic analyses: cost minimization, cost effectiveness, cost utility, and cost benefit. Specification of alternative therapies, choice of perspective of the analysis, measurements of costs and benefits, and the role of discounting, and sensitivity analyses are discussed. Published economic analyses that pertain directly to treatment with radiation therapy are
reviewed. Finally, we close with a brief discussion of the potential areas for future economic outcomes research in radiation oncology. (Abstract by: Author)


This paper discusses the role of economic appraisal in the U.K. National Health Service, with particular emphasis on the impact of the recent reforms. A number of agencies, including the Department of Health, research councils, health authorities and industry, fund appraisals, the majority of which are carried out by academic researchers. To date there is little formal documentation of the impact of appraisals. The recent reforms should, in principle, increase the opportunities and demand for economic appraisal. The reforms establish an internal market for health care with separate roles for purchasers and providers. There are opportunities for using appraisals in deciding whether or not to place a contract, in deciding on the contract specification and in monitoring the prescribing budgets of general medical practitioners. The new NHS research and development strategy also places particular emphasis on research into the effectiveness and cost-effectiveness of health technologies, and on getting the results of research used in decision making. (Abstract by: Author)


This study derives the economic costs of misclassification in nursing home patient classification systems. These costs are then used as weights to estimate the reliability of a functional assessment instrument applied to 290 Veterans Administration nursing home patients. The weighted kappa is used to measure reliability and the results were generally favorable. Use of the unweighted kappa indicated significant reliability problems. It is suggested that reliability must be redefined and remeasured with each substantively new application of an assessment instrument.


New technologies, such as magnetic resonance imaging, are frequently cited as major contributors to the growth of national health care expenditure. The cost-effectiveness of this modality is commonly challenged, and the lack of health economic documentation increases the level of criticism. Some common methods for evaluating imaging methods with regard to efficacy, cost, and benefits are, therefore, reviewed. Limitations in the assessment of diagnostic imaging are discussed, together with some suggestions as to which methodological approaches may be useful in this field of research. (Abstract by: Author)


Cost-effectiveness analysis (CEA) refers to a set of research methods that consider the resources consumed by a medical technology in decisions about how best to use the technology. This analytic method is an evolving, controversial, and often misunderstood field in health services research. The basic set of principles underlying CEA is deceptively simple, but sufficient methodological challenges and controversies exist that have, thus far, limited its use in the development of health policy and in bedside decision making. Nonetheless, neurologists like other specialty groups may feel concerned that the results from such analyses may prove unfavorable to their specialty and the patients they serve. This article reviews the fundamental notions surrounding CEA, provides examples from the literature with particular relevance to the neurological community, and highlights critical issues for neurologists regarding the future of CEA.

Costing data for intensive care admissions is important, not only for unit funding, but also for cost outcome analysis of new therapies. This paper presents an intensive care episode costing methodology using the example of a cost-benefit analysis of mask CPAP for severe cardiogenic pulmonary oedema (CPO). This analysis examines the intervention of admitting all patients with severe CPO to the intensive care unit for mask CPAP, compared with the previous practice of admitting only patients failing conventional non-CPAP treatment and requiring mechanical ventilation. The episode costs were determined from a prospective study which showed mask CPAP reduced the need for mechanical ventilation from 35% to 0%. The mean cost of a mask CPAP episode was $1,156, with a mean stay of 1.2 days, compared with ventilated patients, $5,055 and 4.2 days. The major contributors to cost in both groups were nursing and medical salaries, and hospital overheads. The cost of previous estimated yearly caseload of 35 ventilated patients ($176,925) was greater than the cost associated with an increased caseload of 100 mask CPAP patients ($115,600). We conclude that, despite an increase in admissions, mask CPAP for severe CPO is cost-effective.


Cost-effectiveness analysis is emerging as an approach for determining the relative value of health care programs, technologic innovations, and clinical decisions. Increasingly, patients’ stated values for quality of life are applied as adjustment in these analyses; the results may vary depending on how individuals assess their well-being. We interviewed 58 patients with chronic renal failure to determine the level of agreement among six methods for assessing well-being, and to determine the effects of variation in assessed well-being on the results of a cost-effectiveness analysis of in-center hemodialysis. Patients reported well-being using the Sickness Impact Profile, Campbell Index of Well-being, Kaplan-Bush Index of Well-being, categorical scaling, standard gamble, and time trade-off. We found that patient well-being was substantially higher as evaluated by the Sickness Impact Profile compared to the other five methods. The Sickness Impact Profile and the Kaplan-Bush Index of Well-being provided much narrower distributions of assessed values relative to other measures. Correlations among assessment methods were poor (Spearman rank-correlation coefficients range: 0.094-0.519). Discrepancies among indices were particularly vivid when we evaluated data at the individual level; many patients reported a high level of well-being according to one index and a low level of well-being according to a different index. The cost effectiveness of in-center hemodialysis varied from $34,893 to $45,254 per quality-adjusted life-year saved according to the Sickness Impact Profile and standard-gamble technique respectively. The substantial variability in patients’ stated quality of life may preclude the use of a single method to analyze the cost effectiveness of a health program. (Abstract by: Author)


This article describes the essential features of economic evaluation and how economists have viewed risk. CBA, CEA, and CUA, are addressed, and approaches to evaluating changes in risk (certainty approach, changes in risk per se, willingness-to-pay approach, and the utility approach) are explored.

This paper examines the relationship between cost-effectiveness analysis and cost-benefit analysis. Provided that a cost-effectiveness analysis includes all the relevant societal costs, it is shown that a cost-effectiveness analysis can be interpreted as a cost-benefit analysis where the willingness to pay per effectiveness unit is assumed to be constant and the same for everyone. To relax this assumption the willingness to pay per effectiveness unit can be allowed to vary depending on for instance the size of the health effects and the target population. It is argued that cost-effectiveness analysis is best viewed as a subset of cost-benefit analysis, where the aim of the analysis is to estimate the cost function of producing health effects. It is also concluded that to interpret and use cost-effectiveness analysis as a tool to maximize the health effects for one specified real-world budget, will be inconsistent with a societal perspective and is likely to lead to major problems of suboptimization.


It has been argued that the willingness to pay for health care services in contingent valuation studies should be assessed *ex ante* from an insurance perspective. It may, however, be easier to assess the willingness to pay among a group of patients in need of a specific treatment. This willingness to pay measure can be used to estimate the expected willingness to pay. This paper investigates the relationship between *ex ante* and expected willingness to pay. Is it shown that expected willingness to pay is a lower bound for *ex ante* willingness to pay for a treatment that restores the individual to full health for an individual that is risk averse with respect to income. For a treatment that does not restore and individual to full health the expected willingness to pay is not necessarily a lower bound for the *ex ante* willingness to pay if the marginal utility of income increases with better health.


In this paper, the relationship between willingness to pay for health changes, the human-capital approach, and the costs that should be included in a cost-benefit analysis of a health care program are analyzed. The costs that should be included are defined as the change in consumption minus the change in production of the individual that receives a health care program. The size of these external costs differs depending on the institutional arrangements in society. It is shown that the net production version of the human-capital approach is an estimation of the external costs. The human-capital approach can thus be given a theoretical foundation in cost-benefit analysis if it is used to estimate the external costs. (Abstract by: Author)


Cost-effectiveness analysis has become the dominant method for economic evaluations of health care. Two papers estimating the cost-effectiveness of colorectal cancer screening in Denmark [1] and the UK [2] appear in this issue of Health Economics. In this editorial we discuss two methodological issues in relation to these studies. We first discuss what costs should be included in cost-effectiveness analysis. This is followed by a section about the decision rule of cost-effectiveness analysis, The editorial ends with some concluding remarks. (Abstract by: Author)

The authors use this article to critically examine Birch and Gafni's 1992 analysis of the decision rules of cost-effectiveness/utility analysis (CEA). Birch and Gafni claim that these rules fail to achieve their stated objectives, namely the maximization of health gains for a given amount of resources. In this article, the authors review the optimal decision rules in cost-effectiveness. Second, they show that most of the objections to CEA raised by Birch and Gafni in their examples have no basis if CEA is used in an appropriate way. Third, they address the valid but well-known point about program indivisibilities.


Pharmacoeconomics research is used to identify, measure, and compare the costs, risks, and benefits of programs, services, or therapies and determine which alternative produces the best health outcome for the resources invested. Each pharmacoeconomic method measures costs in monetary terms; the differences lie in the valuation of outcomes. In cost-minimization analysis, the outcomes are considered to be equal and, therefore, are not measured. Cost-benefit analysis measures outcomes in nonmonetary units. In cost-utility analysis, outcomes expressed in nonmonetary units are adjusted for health-related quality of life. A well-designed pharmacoeconomic analysis involves 10 steps:

1. defining the problem
2. determining the study's perspective
3. determining the alternatives and outcomes
4. selecting the appropriate pharmacoeconomic method
5. placing monetary values on the outcomes
6. identifying study resources
7. establishing the probabilities of the outcomes
8. applying decision analysis
9. discounting costs or performing a sensitivity or incremental cost analysis
10. presenting the results, along with any limitations of the study.

By adhering to the analytic steps described, the pharmacist undertaking a pharmacoeconomic evaluation has the greatest likelihood of obtaining valid and useful results.


It has become increasingly popular to carry out cost-effectiveness analyses in economic evaluations of healthcare programs. Cost-effectiveness analysis is based on the maximization of the health effects for a given amount of resources. However, many published studies fail to report the results of cost-effectiveness analysis in a way that is consistent with this underlying aim. The aim of this article is to demonstrate the decision rules of cost-effectiveness analysis in an easily accessible way for practitioners in the field. A hypothetical example is used to demonstrate the decision rules of cost-effectiveness analysis, and we also show how to estimate the appropriate incremental cost-effectiveness ratios and how to exclude dominated alternatives. It is then shown how fixed budgets or predetermined prices per effectiveness unit can be used as decision rules to maximize health effects and to determine which programs to implement on the basis of incremental cost-effectiveness ratios. We hope that the article will contribute towards an increased understanding and application of the appropriate decision rules of cost-effectiveness analysis, so that the results of cost-effectiveness analyses can be interpreted meaningfully by decision-makers. (Abstract by: Author)
Traditionally, economic evaluations in terms of cost-effectiveness analysis are based, explicitly or implicitly, on the assumption of constant returns to scale. This assumption has been criticized in the literature and the role of cost-effectiveness as a tool for decision making has been questioned. In this paper we analyze the case of increasing returns to scale due to fixed capital costs. Cost-effectiveness analysis is regarded as a tool for estimating a cost function. To this cost function two types of decision rules can be applied, the budget approach and the constant price approach. It is shown that in the presence of fixed capital costs the application of these two decision rules to a specific patient group will give different results. The budget approach may lead to suboptimizations, while using the price as a decision rule will give optimal solutions. With fixed capital costs and when an investment can be used for treating several patient groups, these groups are no longer independent. Therefore, the cost-effectiveness analysis has to be performed simultaneously for all patient groups that are potential users of the investment. (Abstract by: Author)


This article begins by showing how decision trees display the choices and uncertainties involved in diagnosis and treatment decisions. The second half of the article discusses the many models used to predict long-run outcomes of treatment (in order of increasing complexity): formulas for life expectancy, Markov chains, Markov processes and simulations.


Many researchers in the field of evaluation of health care doubt the usefulness of estimates of indirect costs of disease in setting priorities in health care. This paper attempts to meet part of the criticism on the concept of indirect costs, which are defined as the value of production lost to society due to disease. Thus far in cost of illness studies and cost-effectiveness analyses the potential indirect costs of disease were calculated. In the following a first step will be taken towards a new method for estimating indirect costs which are expected to be effectuated in reality: the friction cost method. This method explicitly takes into account short and long run processes in the economy which reduce the production losses substantially as compared with the potential losses. According to this method production losses will be confined to the period needed to replace a risk worker: the so-called friction period. The length of this period and the resulting indirect costs depend on the situation on the labor market. Some preliminary results are presented for the indirect costs of the incidence of cardiovascular disease in the Netherlands for 1988, both for the friction costs and the potential costs. The proposed methodology for estimating indirect costs is promising, but needs further development. The consequences of illness in people without a paid job need to be incorporated in the analysis. Also, the relation between internal labor reserves and costs of disease should be further investigated. Next to this, more refined labor market assumptions, allowing for diverging situations on different segments of the labor market are necessary.


Medical, ethical, and societal concerns about costs, access, and quality of care are causing health care practitioners to consider a more comprehensive model for medical decision making. Consequently, interest in research to assess the outcomes of health care has been increasing. The purpose of this paper is to explicate a theoretical framework for identifying, collecting, and using outcomes data to assess the value of pharmaceutical treatment
alternatives. Causal relationships between disease, health outcomes, and decisions about medical care interventions (e.g., treatment with pharmaceutical products and services) are proposed to address limitations inherent in the traditional medical decision-making model. The Economic, Clinical, and Humanistic Outcomes (ECHO) model depicts the value of a pharmaceutical product or service as a combination of traditional clinical-based outcomes with more contemporary measures of economic efficiency and quality. This integrated approach provides a theoretical basis for considering potential trade-offs among economic, clinical, and humanistic variables in optimizing the allocation of health care resources. The ECHO model is a preliminary step to modeling outcomes from pharmaceutical treatments and services. Data collection instruments need to be developed, and the proposed relationships among outcomes variables should be established empirically. The ECHO model should assist health services researchers in planning, conducting, and evaluating pharmaceutical products and services from a multidimensional perspective. (Abstract by: Author)


Cost-utility analysis is increasingly being advocated as a tool for helping to establish funding priorities among programs and services in the health-care sector. As currently conducted, however, cost-utility analysis is problematic as a basis for achieving allocative efficiency because it excludes externalities. The exclusion of externalities may bias program ranking in unpredictable ways, leading to a non-optimal allocation of resources. Consideration of externalities also raises a number of distributional issues for the evaluation of health services and highlights the important of developing economic evaluation methods that are consistent with the conceptual basis for allocating resources. (Abstract by: Author)


Health economic evaluation comprises the systematic appraisal of the costs, the benefits and the relative economic efficiency of different medical interventions. The first section of this paper outlines the techniques of economic analysis and how they relate to the efficient use of health resources. This is followed by a review of the health economics of rheumatoid arthritis as a model for the wider application of health economics in the field of rheumatology. (Abstract by: Author)


For pharmaceutical companies to plan properly the drug development process and meet the needs of formulary committees in the drug approval process, attention must be given to the economic analysis of therapeutic interventions at an early stage in the development process. Modeling therapeutic intervention, where comparator products within disease groups are identified, is a key step in identifying the data required to support outcomes research, which in turn, supports comparative therapy evaluations. The purpose of this paper is to develop a framework for identifying key outcome measures, exploring the role of therapy intervention models while emphasizing the need for a cost-benefit framework. The key outcome measures considered here include both direct and indirect costs, drug substitution, and the assessment of formulary budget impacts. The limitations of cost-effectiveness and cost-utility measures as indicators of welfare outcomes in a resource allocation framework are also emphasized. The principal conclusion is that the early development of a therapy intervention model is essential to the process of drug development and assessment and for the identification of data items
needed to support economic evaluation. Modeling therapeutic interventions must involve agreement on intervention points, treatment pathways, pathway probabilities, and end points of therapy. Unless these parameters are determined, submissions by drug companies to formulary committees and assessments of the market potential for drugs will remain ad hoc in nature and of limited use in any decision process. (Abstract by: Author)


In trying to identify the therapeutic impact of a drug, clinical trials eliminate potentials confounding factors such as comorbidities, poor compliance and treatment errors in diagnosis, dosing, and drug interactions. Elimination of these variables means that attempts to use clinical data as the basis for predicting relative cost-effectiveness are fraught with difficulties. In this article a theoretical framework is proposed, which, for a single drug intervention, examines the relationship between assumed patterns of clinical effectiveness, costs of drug delivery, and the proportion of the prospective patient population being treated. Cost-effectiveness profiles are generated to represent both usual-treatment situations and situations where interventions to reduce misdiagnoses, adverse events, and noncompliance attempt to push clinical effectiveness to a maximum (given the existence of comorbidities). Without data describing effectiveness and cost profiles, and unless strict assumptions are made as to effectiveness and cost functions, profiles of cost-effectiveness cannot be predicted.


The purpose of this paper is to argue that the emphasis in the pharmacoeconomic literature on cost-outcomes ratios as key decision variables in determining drug choice is misplaced. Unless strict assumptions are made (and believed) as to the relationship between numbers of patients treated and the marginal costs and outcomes of therapy, the only basis on which an evaluation of alternative therapy options can be made is an equilibrium-to-equilibrium modeling framework. This specifically refers to the assumption that costs and outcomes functions exhibit constant returns to scale. In this framework, given the expected changes of distribution of patients between therapy options, estimates can be made of net changes in overall treatment costs and outcomes. (Abstract by: Author)


This paper presents a practical blueprint for modeling and evaluating the costs of disease interventions. Retrospective estimates of therapy costs and analyses of various treatment pathways are critical to projecting the likely cost impacts of disease management programs. This presentation outlines the information requirements necessary to identify baseline costs, to set cost outcomes targets, and to monitor costs over the life of an agreement. The chief components of this process are: (1) developing a framework for input cost analysis; (2) identifying costing requirements for various types of disease management interventions; (3) identifying key classifications in such a cost framework; and (4) identifying principal obstacles to cost assessment. (Abstract by: Author)


The purpose of this paper is to challenge the uncritical use of incremental cost-outcomes ratios as decision variables. A scenario is presented which describes conditions under which increasing costs per unit of outcome prevail. Marginal costs increase as the proportion of patients treated under a given therapy increases. If the health system’s objective is to maximise
health benefits then patients will be switched until the marginal benefits per dollar expended are equal between the 2 therapies. In an example where the costs of the new therapy are greater, for a given proportion of patients treated, patients are switched from the existing to the new therapy until an equilibrium is achieved in the allocation of therapies among the treating population. At this point, the overall costs of treatment are at a minimum. This outcome could only be predicted if the underlying cost-outcomes functions are known and the consequent patterns of therapy substitution and cost impacts assessed. The paper concludes by raising concerns as to the role of incremental cost-outcomes ratios as decision variables where increasing costs may be expected to prevail and there is failure to consider the implications of these increasing costs in formulary decision making. If increasing costs are present then conventional cost-outcomes and incremental cost-outcomes ratios are of limited utility as decision variables in the choice of therapy options. (Abstract by: Author)


The use of incremental cost-outcomes ratios as decision variables by those working in the area of pharmacoconomics is commonplace. Unfortunately, few question the assumptions implicit in the use of such ratios. In this paper, the author argues that under certain reasonable assumptions regarding the production of health care and alternative therapy options, if partial substitution or switching between therapy options occurs, it may be possible not only to stay within an initial health care budget, but also to yield higher total outcomes for the treating population. This argument is presented by developing a model of health care costs and outcomes in a dual-therapy environment. (Abstract by: Author)


This paper addresses the problem of increasing costs (or decreasing returns) in the treatment of patients within health care systems. We examine the implications of such a situation for (1) the allocation of patients to alternative drug therapies within a disease area; and (2) the proportions of patients being treated within the disease area to the total patient population as a function of the equilibrium conditions for maximized health care outcomes, given alternative assumptions about the existence of budget constraints on the resources allocated to the disease area. The reason for considering these issues (in this case, from a purely theoretical perspective) is that such a model and the assumptions that drive it stand in marked contrast to those underlying (implicitly if not explicitly) the traditional approach to cost-effectiveness modeling. In traditional cost-effectiveness analysis, the assumption is that costs and outcomes exhibit constant returns to scale and that the process of patient selection and the characteristics of the treating population need not be taken into account. However, our analysis demonstrates that once the assumption of constant returns in abandoned, any assessment of the net impact of therapeutic interventions can be made only within an equilibrium, or comparative static, framework that is subject to budget constraints and in which the cost functions that drive patterns of switching between therapies are specified. Under such conditions, the traditional, clinical-trial-based notion of cost-effectiveness loses all meaning. (Abstract by: Author)


Most economic studies of picture archiving and communication systems (PACS) to date, including our own, have focused on the perspectives of the radiology department and its direct costs. However, many researchers have suggested additional cost savings that may accrue to the medical center as a whole through increased operational capacity, fewer lost images, rapid
simultaneous access to images, and other decreases in resource utilization. We describe here an economic analysis framework we have developed to estimate these potential additional savings. Our framework is comprised of two parallel measurement methods. The first method estimates the cost of care actually delivered through online capture of charge entries from the hospital's billing computer and from the clinical practices' billing database. Multiple regression analyses will be used to model cost of care, length of stay, and other estimates of resource utilization. The second method is the observational measurement of actual resource utilization, such as technologist time, frequency and duration of film searches, and equipment utilization rates. The costs associated with changes in resource use will be estimated using wage rates and other standard economic methods. Our working hypothesis is that after controlling for the underlying clinical and demographic differences among patients, patients imaged using a PACS will have shorter lengths of stay, shorter exam performance times, and decreased costs of care. We expect the results of our analysis to explain and resolve some of the conflicting views of the cost-effectiveness of PACS.  (Abstract by: Author)


During the information systems development within an organization, data resource is typically analyzed in the form of a data model. During this data analysis phase, the data model is further refined so that it obeys certain rules of good behavior. Normalization is the process of grouping data into such well refined structures. Determining an appropriate normal form has not been clear to database systems analysts. An effective methodology for determining normal forms by employing a cost/benefit model coupled with a decision tree is proposed. Three primary variables that impact the benefits and costs of normalization are addressed. The resulting cost/benefit analysis enables database analysts to produce more cost-effective normalized databases.


This article presents 12 good practice guidelines for the conduct of economic evaluation of medicines as adopted by the UK Department of Health.


The purpose of this paper is to continue the dialogue concerning the policy of regulating economic studies of pharmaceuticals.


The complexities and nuances of evaluating the costs associated with providing medical technologies are often underestimated by analysts engaged in economic evaluations. This article describes the theoretical underpinnings of cost estimation, emphasizing the importance of accounting for opportunity costs and marginal costs. The various types of costs that should be considered in an analysis are described; a listing of specific cost elements may provide a helpful guide to analysis. The process of identifying and estimating costs is detailed, and practical recommendations for handling the challenges of cost estimation are provided. The roles of sensitivity analysis and discounting are characterized, as are determinants of the types of costs to include in an analysis. Finally, common problems facing the analyst are enumerated with suggestions for managing these problems.
Federal law requires the Food and Drug Administration (FDA) to regulate the promotional claims of prescription drugs and certain devices. Standards of evidence for claims of safety and therapeutic efficacy are rigorous because inappropriate product use may place human life at risk. However, equally demanding criteria for claims of cost-effectiveness of marketed technologies seem to be unnecessary because the consequence of error is principally a bad buy rather than patient harm. Concern exists about the validity of cost-effectiveness studies, the potential for bias, standards for the conduct of cost-effectiveness research, and the needs of managed care. The FDA should moderate its role in regulating cost-effectiveness claims of drugs and devices. This would foster information flow to healthcare providers and insurers and protect the FDA concern regarding false or misleading claims of effectiveness. Although the issues are applicable to both devices and drugs, we draw mainly from the field of pharmacoeconomics because this is where most of the policy has developed. (Abstract by: Author)

Methods of evaluating socioeconomic relationships have evolved over many years, and a number of specific approaches have been developed. Among the techniques available, cost-effectiveness analysis (CEA) has emerged as the most widely used and accepted method. Yet, despite considerable effort by the analytical community to refine this technique into one more useful for making health policy decisions, much debate and confusion still persist among analysts, readers, and policy-makers concerning methods standards and the overall usefulness of CEA in resource allocation decision making. Thus the purpose of this paper is to summarize, critically examine, and comment on existing recommended methods for socioeconomic evaluation of health care interventions. In particular, we examine an exhaustive set of component methods within the general area of cost-effectiveness and comment on areas of apparent consensus and debate. Our review reveals many areas of agreement and many yet to be resolved. Analysts generally agree on the components of the overall framework for an analysis; basic methodologic principles; the general treatment of costs; the principle of marginal analysis; the need for and general approach to discounting; the use of sensitivity analysis; the extent to which ethical issues can be incorporated; and the importance of choosing appropriate alternatives for comparison. The principal areas in which disagreement still persists are choice of study design, measurement and valuation of health outcomes including conversion of health outcomes to economic values, transformation of efficacy results into effectiveness outcomes, and the empirical measurement of costs.

Anti-infective drugs account for between 3 and 25% of all prescriptions, between 6 and 21% of the total market value of drugs in a single country, and up to 50% of the drug budget in hospitals. Not surprisingly, in an era when cost-containment policies are at the top of the agenda, issues related to pharmacoeconomics of antibacterial treatment have assumed an important part in these policies. However, there are still some misunderstandings regarding the precise terminology and difference in methodology of pharmacoeconomics. The aim of this paper is to explain the genealogy of pharmacoeconomics and various methods currently used in the application of this young discipline to anti-infective treatment. (Abstract by: Author)

The purposes of this article is to provide an overview of modeling to estimate net effectiveness in a CEA (the difference in effectiveness between an intervention and the alternative to which is being compared).


This paper discusses the need for reporting guidelines for economic studies, based on a review of 147 studies contained in a register compiled by the Department of Health in the United Kingdom. It then discusses previous reviews of reporting standards. Next, it outlines the main deficiencies in reporting observed in the studies on the register and discusses the need for better standards in the future.


Decisions to allocate resources in health care are increasingly influenced by relative cost effectiveness. To warn decision makers of some of the pitfalls currently found in cost effectiveness league tables and to suggest how meaningful comparisons may be made between health care technologies a published league table was scrutinised by examining its sources. This showed some of the methodological problems surrounding such tables and how such difficulties could be reduced in future. The source studies in the table featured different years of origin, discount rates, health state evaluations, settings, and types of comparison programmes; all of these differences may raise problems for meaningful comparison. Decision-makers need to assess the relative value for money of competing health care interventions. In the absence of systematic comparisons such assessments are likely to take place informally. This will probably have a worse risk-benefit trade off than the formalized use of league tables.


Guidelines for the pharmacoeconomic field should focus on correctly defining and using terms. Directions should also be provided for suitable methodologies and for ways of presenting findings. Examples of proper applications of pharmacoeconomic study and their results should be included. The guidelines should also suggest ways to avoid bias and ethical conflicts. To be most effective, the guidelines should be comprehensive enough so that researchers can adequately regulate research results, yet flexible enough to accommodate applications in many areas of interest.


The objective of this paper is to provide an understanding of economic evaluation as applied to health care. A number of methodological issues are explained. Measurement issues are outlined and examples given. (Abstract by: Author)


Promising new technologies have to be carefully analyzed before their integration into clinical practice. Moreover, the existing technologies need to be confronted with the new ones in terms of effectiveness and efficiency. Logical guidelines for both clinical and economic
evaluation are described in the present review paper which mainly deals with diagnostic technology. All the proposed steps are not instrumental for each technology assessment but they provide a more rational approach to the acceptance and diffusion of technology.  

(Abstract by: Author)


Most medical cost-effectiveness analyses include future costs only for related illnesses, but this approach is controversial. This paper demonstrates that cost-effectiveness analysis is consistent with lifetime utility maximization only if it includes all future medical and non-medical expenditures. Estimates of the magnitude of these future costs suggest that they may substantially alter both the absolute and relative cost-effectiveness of medical interventions, particularly when an intervention increases length of life more than quality of life. In older populations, current methods overstate the cost-effectiveness of interventions which extend life compared to interventions which improve the quality of life.  

(Abstract by: Author)


The analysis of published survival curves can be the basis for incremental cost-effectiveness evaluations in which two treatments are compared with each other in terms of cost per life-year saved. The typical case is when a new treatment becomes available which is more effective and more expensive than the corresponding standard treatment. When effectiveness is expressed using the end-point of mortality, cost-effectiveness analysis can compare the (incremental) cost associated with the new treatment with the (incremental) clinical benefit measured in terms of number of life-years gained. The (incremental) cost-effectiveness ratio is therefore quantified as cost per life-year gained. This pharmacoeconomic methodology requires that the total patient years for the treatment and the control groups are estimated from their respective survival curves. We describe herein a survival-curve fitting method which carries out this estimation and a computer program implementing the entire procedure. Our method is based on a non-linear least-squares analysis in which the experimental points of the survival curve are fitted to the Gompertz function. The availability of a commercial program (PCNONLIN) is needed to carry out matrix handling calculations. Our procedure performs the estimation of the best-fit parameters from the survival curve data and then integrates the Gompertz survival function from zero-time to infinity. This integration yields the value of the area under the survival curve (AUC) which is an estimate of the number of patients years totaled in the population examined. If this AUC estimation is performed separately for the two survival curves of two treatments being compared, the difference between the two AUCs permits to determine the incremental number of patient years gained using the more effective of the two treatments as opposed to the other. The cost-effectiveness analysis can consequently be carried out. An example of application of this methodology is presented in detail.  

(Abstract by: Author)


Clinical trials and meta-analyses of trials are models of clinical reality. A pharmacoeconomic model is a logical, quantitative blend of therapeutic and/or disease management strategies, evidence-based clinical outcomes, patient survival data and/or quality-of-life (utility) data, epidemiological data and costs. Pharmacoeconomic models can link evidence-based medicine to the local environment. They require locally appropriate resource consumption and cost information, so that the economic outcomes (e.g., cost and cost-
effectiveness of therapy) are current and locally relevant. Decision analytical models represent a sequence of chance events and decisions over time and are appropriate for acute episodes of illness, whereas Markov models represent recurring health states and are useful in describing chronic illness. Epidemiological models combine clinical trial data with observational data, and can be used for predicting the efficiency of risk management strategies such as vaccination and antihypertensive therapy. User-friendly commercial modeling software is available. For maximum credibility, pharmacoeconomic models should build on validated disease management protocols and/or landmark clinical trials or meta-analyses of trials. They should also adhere to published standards for economic analysis, including the use of locally relevant comparators, discounting to present value, extensive sensitivity analysis, and appropriate health utility values. Models should be presented fully with the logical structure plus all decision probabilities and/or state transition probabilities plus unit costs and resource consumption. A standard reporting format for publication in peer-reviewed journals has been suggested. Models can be timely, adaptable, relatively inexpensive, and often the only way to obtain appropriate information on the clinical, economic and humanistic outcomes of disease management protocols. However, without due care they can be obscure and open to bias and misunderstanding. Both the analyst and the user must avoid mistaking obscurity for profundity.


In so far as economics can make a visible contribution to health care planning this will normally be seen in the form of the results of various analyses. Such data will, hopefully, lead to more rational decision making and hence improved health care, and more health from the available resources. But the methodology of economics is more important than all the analyses and the data arising from it. Economic analysis is a way of thinking and a science of behavior. If the medical profession thinks of economics as something that only economics do, then economics cannot make any real contribution to health care planning and evaluation.


The concept of opportunity cost and therefore the notion of sacrifice are central to health economics. Applying economic principles is aimed at maximizing the benefits, however defined, from the resources available. To do this the Health Service needs to find the most cost-effective solutions in pursuing its objectives at all levels.


Perhaps the only need that is absolute is the need to banish the view that the health service should be about meeting total need. Such an attitude, abhorrent to economists, results in confused thinking and romanticism in health care planning.


This article examines the organization of health care resources. Its conclusions are summated in the second (continuation) part of this article.

As economists we cannot remain credible if we fail to understand the health and health care phenomena we seek to analyze. Whether we have succeeded in this respect in the important area of analyzing treatment choices will be apparent in the next article. What is apparent is that health economics is too important to be left to health economists alone.


This article has two main objectives. The first is to layout a conceptual framework in which a formal statistical cost-effectiveness analysis is but one aspect of a broader set of decision or analytical issues. The second is to offer a brief (and unusually nonrepresentative) survey of some advances in statistical methodology that are likely to be particularly important in the statistical component of CEA..


Many clinical practice guidelines fail to account for the preferences of the individual patient. Approaches that seek to include the preferences of the individual patient in the decision-making process (e.g., interactive videodisks for patient education), however, may incur substantial incremental costs. Developers of clinical practice guidelines must therefore determine whether it is appropriate to make their guidelines flexible with regard to patient preferences. The authors present a formal method for determining the cost-effectiveness of incorporating the preferences of individual patients into clinical practice guidelines. Based on utilities assessed from 37 patients, they apply the method in the setting of mild hypertension. In this example, they estimate that the cost-effectiveness ratio for individualized utility assessment is $48,565 per quality-adjusted year of life, a ratio that compares favorably with other health interventions that are promoted actively. This approach, which can be applied to any clinical domain, offers a formal method for determining whether the incorporation of individual patient preferences is important clinically and is justified economically. (Abstract by: Author)


This article focuses on the challenges involved for public payers and what we can realistically expect a cost-effectiveness criterion to accomplish.


The interest of nurses in methods of economic evaluation appears limited to cost-effectiveness analysis, with an apparent unawareness of other methods of economic appraisal and the types of efficiency they consider. The main methods of economic appraisal are discussed, and linked to different kinds of efficiency. Methods for the valuation of health states, an important accompaniment to the methods of economic appraisal, are briefly described along with some of the practical difficulties. If skilled nursing care--alone or with other disciplines--changes health status then the measurement and valuation of such states may be used to inform resource allocation decisions involving nursing. It could be argued that the main impact of nursing is on quality of life, and if so this suggests cost utility analysis, and not cost-effectiveness analysis, as the natural level of appraisal for nursing. The use of these methods
in research, and participation in their future development, are both suggested as valid targets for nurses to aim for. (Abstract by: Author)


This article reviews threats to the validity of pharmacoeconomic studies using the data from RCTs. It identifies seven categories of problems and demonstrate how these affect two modes of inquiry for economic evaluations in which RCT data are used: retrospective decision analytical modeling and prospective RCT "piggy back' analysis.


There is a growing demand for economic evaluation of new therapeutic interventions to provide health care decision makers with information on the relative value for money offered by alternative treatments. We review the rationale for economic evaluation and distinguish among four analytic techniques: cost minimization analysis, cost effectiveness analysis, cost utility analysis, and cost benefit analysis. Each technique is illustrated with an example from the literature. (Abstract by: Author)


There is growing interest in the application of cost-benefit analysis (CBA) as a technique for the economic evaluation of health care programs. A distinguishing feature of CBA is that costs and benefits are expressed in the same units of value--typically money. A popular method for estimating money values for health care programs is the use of willingness-to-pay (or accept) survey techniques known as contingent valuation. This paper presents a conceptual framework to help in the interpretation or design of contingent valuation studies in health care. To be consistent with the theory upon which CBA is built, the authors consider what types of questions should be asked of what populations. They conclude that studies undertaking contingent valuation should distinguish between compensating variation and equivalent variation, and recognize that respondents can be gainers or losers in utility and therefore should be asked willingness-to-pay (or accept) questions as appropriate. Current critical-appraisal guidance in the health care literature for CBA is poor and unlikely to offer useful demarcation between good and bad CBA studies. More work is needed exploring whether recently issued guidelines for contingent valuation in environment damage assessment are applicable to health care studies. (Abstract by: Author)


Application of techniques such as cost-effectiveness analysis (CEA) is growing rapidly in health care. There are two general approaches to analysis: deterministic models based upon assumptions and secondary analysis of retrospective data, and prospective stochastic analyses in which the design of a clinical experiment such as randomised controlled trial is adapted to collect patient-specific data on costs and effects. An important methodological difference between these two approaches is in the quantification and analysis of uncertainty. Whereas the traditional CEA model utilizes sensitivity analysis, the mean-variance data on costs and effects from a prospective trial presents the opportunity to analyze cost-effectiveness using conventional inferential statistical methods. In this study we explored some of the implications of moving economic appraisal away from deterministic models and toward the experimental
paradigm. Our specific focus was on the feasibility and desirability of constructing statistical
tests of economic hypotheses and estimation of cost-effectiveness ratios with associated 95%
confidence intervals. We show how relevant variances can be estimated for this task and
discuss the implications for the design and analysis of prospective economic studies. (Abstract
by: Author)


The development of methods to measure willingness to pay (WTP) has renewed interest
in cost-benefit analysis (CBA) for the economic evaluation of health care programs. The
authors studied the construct validity and test-retest reliability of WTP as a measure of health
state preferences in a survey of 102 persons (mean age 62 years; 54% male) who had chronic
lung disease (forced expiratory volume < 70%). Interview measurements included self-reported
symptoms, the oxygen-cost diagram for dyspnea, Short-Form 36 for general health status,
rating scale and standard gamble for value and utility of current health state relative to death
and healthy lung functioning, and WTP for a hypothetical intervention offering a 99% chance of
healthy lung functioning and a 1% chance of death. WTP was elicited by a simple bidding
game. To test for starting-point bias, the respondents were randomly assigned to one of five
starting bids. All health status and preference measurements except WTP (controlling for
income) showed significant (p < 0.05) difference between disease-severity groups
(mild/moderate/severe). WTP was significantly (p = 0.01) associated with household income,
but other health status and preference measure were not. The measure most highly correlated
with WTP was standard gamble (r = -0.46). There was no association between starting bid and
mean WTP adjusted for income and health status. The test-retest reliability of WTP was
acceptable (r = 0.66) but lower than that for the standard gamble (r = 0.82). It is concluded that:
1) large variation in WTP responses may compromise this measure’s discriminant validity; 2)
there is some evidence of convergent validity for WTP with preferences measured by standard
gamble; 3) there was no evidence of starting point basis; 4) the test-retest reliability of WTP is
comparable to those of other preference measures. (Abstract by: Author)


A framework for quantifying uncertainty about costs, effectiveness measures, and
marginal cost-effectiveness ratios in complex decision models is presented. This type of
application requires special techniques because of the multiple sources of information and the
model-based combination of data. The authors discuss two alternative approaches, one based
on Bayesian inference and the other on resampling. While computationally intensive, these are
flexible in handling complex distributional assumptions and a variety of outcome measures of
interest. These concepts are illustrated using a simplified model. Then the extension to a
complex decision model using the stroke-prevention policy model is described. (Abstract by
Author)

Power, E.J. and J.M. Eisenberg (1998). “Are We Ready to Use Cost-Effectiveness Analysis in
Health Care Decision-making? A Health Services Research Challenge for Clinicians, Patients,
Health Care Systems, and Public Policy.” Medical Care 35(5 Supplement): MS10-MS17.

The dominance of managed care as an organizing principle for health care delivery
suggests that cost-effectiveness analysis (CEA) may be applied increasingly to decision-making
at all levels. Health services researchers now need to address questions of how to further the
underlying methods of CEA, how to make it a more practical tool for market-based as well as
public policy decisions, and how to enhance CEA’s ability to lead to responsible decisions that
result in more effective and efficient care. (Abstract by: Author)

This paper highlights possible deficiencies with the clinical measures conventionally used in effectiveness and cost-effectiveness studies in terms of the benefits of health care perceived by patients.


In this era of rapid change in our health care system, we will be required to demonstrate that our practices and procedures in gastroenterology are both effective and cost-effective. In the face of rising national health care expenditures, the medical profession confront an increased demand to justify practices and to demonstrate the value of its services. This has led to both an expansive literature examining the cost-effectiveness of practices and procedures and an alarming disparity in the definition and use of the term “cost-effectiveness.” Many reports may be lacking appropriate documentation of costs and benefits, the critical components for the determination of cost-effectiveness. Objective: The purpose of this article was to define what is meant by a "cost effective" intervention, with special reference to gastroenterology. Methods: The varied use of the term "cost-effective" in the gastroenterology literature is illustrated. Accepted definitions of the term are provided, and suggested uses are outlined. The value judgments that must be made in funding decisions are presented, and the parameters that may be used to determine the cost-effectiveness of a procedure or practice are discussed. Summary: Cost-effectiveness as it applies to GI medicine is defined, and appropriate and inappropriate uses of the term are illustrated. It is only through effective communication and precise definitions that we will be able to determine the cost-effectiveness of our practices in gastroenterology.


Many difficulties are inherent to pharmacoeconomic studies. Because these studies are observational, there are many factors that cannot be controlled; for example, there are many variations across the country in the practice of any particular therapy. Therefore, designing a case report form that will match the source documents from various investigator sites is not easy. Issues arise in every activity such as choice of investigator site, data collection, data analysis, and interpretation of the results. These issues will be discussed, and an example of a pharmacoeconomic study conducted to evaluate the cost-effectiveness of patch testing in patients diagnosed with allergic contact dermatitis will be presented. (Abstract by: Author)


The principles, methods, and applications of pharmacoeconomics and pharmaceutical outcomes evaluations are discussed. Pharmacoeconomics may be defined as balancing the cost with the consequences (outcomes) of pharmaceutical therapies and services. As a type of outcomes evaluation, pharmacoeconomics looks beyond just the direct or acquisition cost of a pharmaceutical by including its impact on total health resource utilization and costs. Outcomes research attempts to answer the question, What difference does the pharmaceutical make in patient outcomes under real-world conditions? The economic, clinical, and humanistic outcomes (ECHO) model for a pharmacoeconomic evaluation views the drug as some combination of its clinical, economic, and humanistic attributes. Safety and effectiveness are no longer the only salient attributes of a drug; the effect on total health resource utilization, cost, and quality of life must also be evaluated. The four types of pharmacoeconomic methods are cost-minimization analysis, cost-benefit analysis, cost-effectiveness analysis, and cost-utility analysis. As disease
state management continues to emerge as a cost-management, quality assurance strategy, formularies per se will wane in importance and pharmacoeconomic and outcomes data will increase in relevance as health professionals endeavor to find the most efficient and effective combinations of medical care. Pharmacoeconomics as a component of outcomes research will help pharmacists decide which clinical circumstances, patient characteristics, and practice settings are most suitable for particular interventions. (Abstract by: Author)


Policy-makers worldwide are on a quest to control national spending for health care and to enhance the value received for whatever is being spent on health care. One should think that the economic evaluation of clinical practice would play a major role in this quest. Alas, so far it has not, in spite of considerable progress in the development of suitable methodology for such evaluations. The central point of this paper is that the sheer conceptual and practical complexities of economic evaluations in this context are not the only and possibly not the major barrier to a more widespread use of this type of analysis. Just as important may be the suspicion among lay persons that such analyses are easily driven by the assumptions the analyst packages into the analysis which, in turn, opens economic evaluation to hidden bias toward favored results. It is proposed in this paper that this particular barrier to the use of economic evaluations in health policy could be overcome if these analyses were more routinely subjected to the rigorous and penetrating audits that are customary in financial accounting. Typically, research papers in economics are audited through peer review only as to the methodology employed. The suggestions here is that a proper, respectable audit ought to penetrate all the way to the data that were used to produce the findings in a study. The paper concludes with some suggestions on how to develop such an audit infrastructure. (Abstract by: Author)


The paper re-examines the issue of the appropriate unit for measuring output in cost utility analysis and the technique that will measure it. There are two main themes. The first is that utility, as it is often conceived and quantified, is not an appropriate basis for measurement. Consequently, a question arises concerning the selection of an appropriate unit of measurement. The second theme is that there is a need to establish criteria for the evaluation of measurement units. Four criteria are proposed which follow from commonly accepted social objectives and from the requirements of a measurement unit. It is concluded that, as judged by these criteria, the measurement units produced by the time trade-off and person trade-off (equivalence) techniques are more satisfactory than the units produced by the rating scale, magnitude estimation or the standard gamble.


It is an inescapable fact of any health care system that consumers are not the agents who decide between technical alternatives. Consequently, the agents making choices need an acceptable framework for measuring and comparing costs and benefits of competing programs. Cost Utility Analysis (CUA) is proposed as the appropriate framework for health care decision making. It combines the significant aspects of health (quality and quantity of life) that are gained from an intervention. At present, there is no other methodology, which does this in a way that permits decisions to be based on consumer preference. (Abstract by: Author)

This paper indicates that certain economic evaluation methods (cost-effectiveness and cost-utility analyses) may yield inconsistent results. Along with the lack of formal grounding of these methods in economic "first principles," this finding suggests the possible benefit of greater reliance on the more formally developed method of cost-benefit analysis. (Abstract by: Author)


Discusses the great standards debate that has been taking place in health care over the last few years. No matter what the outcome of the standards "movement," they will require care in implementation to ensure on the one hand that they accomplish something helpful and on the other hand that they do not overly restrict research, engender a false sense of security, or simply get it wrong.


Cost-benefit analysis is probably the most comprehensive method of economic evaluation available and it can be applied in two ways. The human capital approach means that the value of people's contributions is linked to what they are paid. The approach based on individuals' observed or stated preference means that their personal valuations are placed on an activity by assessing how much money they are prepared to accept for an increased risk or to pay for a particular service. Each method has its disadvantages and the most successful that has been devised so far is the "willingness to pay" (stated preference) approach, though the response to this is to a large extent dependent on the income of the person being questioned. There are still problems with its application, however, so its usefulness is limited.


When different health care interventions are not expected to produce the same outcomes both the costs and the consequences of the options need to be assessed. This can be done by cost-effectiveness analysis, whereby the costs are compared with outcomes measured in natural units—for example, per life saved, per life year gained, and per pain or symptom free day. Many cost-effective analyses rely on existing published studies for effectiveness data as it is often too costly or time consuming to collect data on cost and effectiveness during a clinical trial. Where there is uncertainty about the costs and effectiveness of procedures sensitivity analysis can be used, which examines the sensitivity of the results to alternative assumptions about key variables. In this article Ray Robinson describes these methods of analysis and discusses possibilities for how the benefits of alternative interventions should be valued.


Whatever kind of economic evaluation you plan to undertake, the costs must be assessed. In health care these are first of all divided into costs borne by the NHS (like drugs), by patients and their families (like travel), and by the rest of society (like health education). Next the costs have to be valued in monetary terms; direct costs, like wages, pose little problem, but indirect costs, (like time spent in hospital) have to have values imputed to them. And that is not all: costs must be further subdivided into average, marginal, and joint costs, which help decisions on how much of a service should be provided. Capital costs (investments
in plant, buildings, and machinery) are also important, as are discounting and inflation. In this second article in the series Ray Robinson defines the types of costs, their measurement, and how they should be valued in monetary terms.


Decisions have to be made about allocating health resources. Currently the best economic evaluation method for doing this is cost-utility analysis. This compares the costs of different procedures with their outcomes measured in “utility based” units—that is, units that relate to a person’s level of wellbeing. The most commonly used unit is the quality adjusted life year (QALY). QALYs are calculated by estimating the total life years gained from a procedure and weighting each year to reflect the quality of life in that year. To compare outcomes of different programmes the Rosser index is one measure of life years gained from a procedure, this enables QALYs to be calculated and procedures ranked according to cost per QALY gained. In this article Ray Robinson explains the measures used and discusses how QALY league tables can be used to guide decisions on resource allocation.


Ever since the concept of value for money in health care was introduced into the NHS, economic terms and jargon have become a part of our everyday lives—but do we understand that the different types of economic evaluation all mean, particularly those that sound similar to the uninitiated? This article introduces readers to the purpose of economic evaluation, and briefly explains the differences between cost-minimization analysis (used when the outcomes may vary, but can be expressed in common natural units, such as mm Hg for treatments of hypertension); cost-utility analysis (used when outcomes do vary—for example, quality of life scales); and cost-benefit analysis (used when a monetary value is being placed on services received). Further articles will deal with each one in more detail.


The author illustrates the basic difference between CEA and DEA with an elementary numerical example. Then he does a "quick and dirty" DEA for a published data set from a recent access to a health care study. (Abstract by: Author)


The authors detail a six-principle methodology (Udvarhelyi et al., 1992) to be followed by investigators conducting pharmacoeconomic analyses:

1. state the perspective; 2. describe the benefits; 3. specify the types of costs; 4. use discounting; 5. perform sensitivity analysis; 6. calculate the cost/effectiveness ratio and express it in incremental terms.


Discusses interventions for which cost-effectiveness analyses have been done and for which life-years are a reasonable measure of health outcome. While this is important, there are many other interventions that go without cost-effectiveness analysis, whose opportunity costs may be much greater or much less. Comparisons across the full range of medical interventions require the use of an outcome measure, such as the quality-adjusted life-year, that can accommodate these different outcomes.

OBJECTIVE: To develop consensus-based recommendations guiding the conduct of cost-effectiveness analysis (CEA) to improve the comparability and quality of studies. The recommendations apply to analyses intended to inform the allocation of health care resources across a broad range of conditions and interventions. This article, first in a 3-part series, discusses how this goal affects the conduct and use of analyses. The remaining articles will outline methodological and reporting recommendations, respectively. PARTICIPANTS: The Panel on Cost-Effectiveness in Health and Medicine, a nonfederal panel with expertise in CEA, clinical medicine, ethics, and health outcomes measurement, was convened by the US Public Health Service (PHS). EVIDENCE: The panel reviewed the theoretical foundations of CEA, current practices, and alternative procedures for measuring and assigning values to resource use and health outcomes. CONSENSUS PROCESS: The panel met 11 times during 2 1/2 years with PHS staff and methodologists from federal agencies. Working groups brought issues and preliminary recommendations to the full panel for discussion. Draft recommendations were circulated to outside experts and the federal agencies prior to finalization. CONCLUSIONS: The panel's recommendations define a "reference case" cost-effectiveness analysis, a standard set of methods to serve as a point of comparison across studies. The reference case analysis is conducted from the societal perspective and accounts for benefits, harms, and costs to all parties. Although CEA does not reflect every element of importance in health care decisions, the information it provides is critical to informing decisions about the allocation of health care resources. (Abstract by: Author)


The current role of economic appraisal in health policy and medical practice is outlined, emphasizing the pharmaceutical sector where developments are most marked. General health policy in the Netherlands and pharmaceutical policy in Australia are presented as examples of how economic appraisal may diffuse further as a decision-support tool for health authorities. This can be promoted by studying how policy-makers interpret and use results of economic evaluation studies and how the international transferability of information on the cost-effectiveness profiles of health technologies can be enhanced. To be relevant for health policy, results from economic appraisal studies must be valid and reliable, relevant to the policy context and communicated to the proper decision-makers. A number of recommendations are provided for economic appraisals to meet such requirements. (Abstract by: Author)


OBJECTIVE: To discuss the calculation and application of confidence intervals in pharmacoeconomic studies. DATA SYNTHESIS: The increasing frequency with which pharmacoeconomic evaluations are made within clinical trials makes it possible to obtain information on the outputs and costs of an intervention in each patient of a sample under study. This allows the same statistical principles commonly used in clinical trials to be applied to cost or cost-effectiveness data. The methodology described in this article would allow expression of cost-effectiveness ratios in the form of confidence intervals. The calculation of the cost-effectiveness ratio by means of a confidence interval may have important practical consequences, both in decision-making on the choice of 1 intervention versus another and in calculating the size of the sample necessary to identify statistically significant differences, from both clinical and economic points of view. CONCLUSIONS: The complementary use of confidence intervals and sensitivity analysis makes it possible to measure uncertainty related and unrelated to variability in sample data, allowing the decision to adopt 1 technology or
another to be based on the most objective information available. Although several ethical and methodologic concerns remain to be addressed, this methodology may contribute to improving the more rational and efficient use of drugs.


Increased pressure to quantify and justify the value of pharmaceutical products and services has made pharmoeconomics a critical new discipline of the pharmacy profession. This continuing series on pharmoeconomics is designed to introduce the pharmacist to the principles and methods of pharmoeconomics, discuss the practical application of pharmoeconomics to a hospital setting, and describe the hospital pharmacist's role in this emerging new discipline. (Abstract by: Author)


Given the current cost-conscious health care environment, pharmacists must now be able to assess the effects of an agent from safety, efficacy, and value considerations. This article describes the various methodologies that may be used in performing pharmacoconomic analyses and highlights the use and misuse of pharmacoeconomic terminology. Case studies relating the use of these methods to the pharmacy practice setting are presented. The technical nuances of the various methods are explained to promote a better understanding of the appropriate use of these techniques and the terminology used to describe them. (Abstract by: Author)


Economic evaluation of pharmaceutical products, or pharmacoconomics, is a rapidly growing area of research. Pharmacoeconomic evaluation is important in helping clinicians and managers make choices about new pharmaceutical products and in helping patients obtain access to new medications. Over the last few years, the scientific rigor of this field has increased greatly. At the same time, new types of analysis, based on prospective data collection, have been developed. This article reviews the basic concept of pharmacoconomics, the types of data available for economic evaluation, and the "state of the art" in pharmacoconomics as reported in the medical literature. (Abstract by: Author)


Economic appraisal is increasingly being used to inform health care decision-making. To allow comparison, costs and benefits spread over time are weighted according to when they are experienced. The further in the future, the less heavily they are weighted or the more they are discounted. Traditional economic appraisal techniques are based on the view that social decisions should reflect private preferences. The practice of discounting future streams of costs and benefits is principally justified by the fact that individuals have a positive time preference, preferring consumption sooner rather than later. Discounting weights public decision-making in favour of interventions resulting in short-term benefits and against longer-term benefits. This discriminates against preventive and other public health programmes. This paper provides a critique of the foundations of discounting. It is argued that health policy should have a longer time horizon, reflecting social values rather than individual preferences. Factors which make discounting the future rational from the individual's point of view are shown to be irrelevant to a societal perspective. Although uncertainty about the effectiveness of interventions and technological change are good reasons for weighting some future benefits less highly, the
routine use of a single discount rate for economic evaluations of health programmes is not justified. (Abstract by: Author)


A statistical framework is presented for examining cost and effect data on competing interventions obtained from an RCT or from an observational study. Parameters of the join distribution of costs and effects or a regression function linking costs and effects are used to define cost-effectiveness (c-e) measures. Several new c-e measures are proposed that utilize the linkage between costs and effects on the patient level. These measures reflect perspectives that are different from those of the commonly used measures, such as the ratio of expected cost to expected effect, and they can lead to different relative rankings of the interventions. The cost-effectiveness of interventions are assessed statistically in a two stage procedure that first eliminates clearly inferior interventions. Members of the remaining admissible set are then rank ordered according to a c-e preference measure. Statistical techniques, particularly in the multivariate normal case, are given for several commonly used c-e measures. These techniques provide methods for obtaining confidence intervals, for testing the hypothesis of admissibility and for the equality of interventions, and for ranking interventions. The ideas are illustrated for a hypothetical clinical trial of antipsychotic agents for community-based persons with mental illness. (Abstract by: Author)


This article reports the recommendations of the Panel on Cost Effectiveness in Health and Medicine, sponsored by the US Public Health Service, on standardised methods for conducting cost-effectiveness analyses. Although not expressly directed at analyses of pharmaceutical agents, the Panel’s recommendations are relevant to pharmacoeconomic studies. The Panel outlines a ‘Reference Case’ set of methodological practices to improve quality and comparability of analyses. Designed for studies that inform resource-allocation decisions, the Reference Case includes recommendations for study framing and scope, components of the numerator and denominator of cost-effectiveness ratios, discounting, handling uncertainty and reporting. The Reference Case analysis is conducted from the societal perspective, and includes all effects of interventions on resource use and health. Resource use includes ‘time’ resources, such as for caregiving or undergoing an intervention. The quality-adjusted life-year (QALY) is the common measure of health effect across Reference Case studies. Although the Panel does not endorse a measure for obtaining quality-of-life weights, several recommendations address the QALY. The Panel recommends a 3% discount rate for costs and health effects. Pharmacoeconomic studies have burgeoned in recent years. The Reference Case analysis will improve study quality and usability, and permit comparison of pharmaceuticals with other health interventions. (Abstract by: Author)


OBJECTIVE: This article, the third in a 3-part series, describes recommendations for the reporting of cost-effective analyses (CEAs) intended to improve the quality and accessibility of CEA reports. PARTICIPANTS: The Panel on Cost-Effectiveness in Health and Medicine, a nonfederal panel with expertise in CEA, clinical medicine, ethics, and health outcomes measurement, convened by the US Public Health Service. EVIDENCE: The panel reviewed the theoretical foundations of CEA, current practices, alternative methods, published critiques of CEAs, and criticisms of general CEA methods and reporting practices. CONSENSUS
PROCESS: The panel developed recommendations through 2 1/2 years of discussions. Comments on preliminary drafts were solicited from federal government methodologists, health agency officials, and academic methodologists. CONCLUSIONS: These recommendations are proposed to enhance the transparency of study methods, assist analysts in providing complete information, and facilitate the presentation of comparable cost-effectiveness results across studies. Adherence to reporting conventions and attention to providing information required to understand and interpret study results will improve the relevance and accessibility of CEAs. (Abstract by: Author)


IT Investment Management (ITIM) allows firms consistently to obtain returns on their IT investments up to 50% higher than many of their competitors. Companies insisting on favorable financial cost-benefit analyses for each IT system are missing out on IT’s potential. To create value, proposals need to show how they make an organization more competitive, increase customer satisfaction and/or improve operational effectiveness.


Due to the increased need for cost-containment policies, most decision-makers are facing the issue of the efficiency of health care strategies. In this context, economic evaluation becomes a major instrument. However, the credibility of economic data depends on a number of methodological steps: selection of strategy of economic evaluation (cost/effectiveness, cost/benefit, generation of economic hypotheses, study design (cross-sectional, prospective, naturalistic), data collection (data-base, physicians), data analysis (costing, statistics). In this respect, the conduct of proper economic evaluation relies on a combination of expertise in clinical epidemiology as well as in health economics. (Abstract by: Author)


The article addresses two basic concepts of health care economics: cost and benefits. It also discusses the three types of common economic analysis: cost-identification analysis, cost-effectiveness analysis, and cost-benefit analysis. In providing a better understanding of the two basic concepts coupled with a working knowledge of the three types of economic analysis, the article attempts to provide a better understanding that will allow physicians and professional to more efficiently criticize health care economics.


This article reviews several guidelines designed to reduce bias in outcomes and cost-effectiveness research.


Two methods have been presented for estimating cost-effectiveness ratios under conditions of second-order (model) uncertainty: one method estimates a mean ratio of cost to effect (the "mean ratio" approach), and the other estimates a ratio of mean cost to mean effect (the "ratio of means" approach). However, the question of which estimate is theoretically correct has not been formally addressed. The authors show that the "ratio of means" approach follows directly from the theoretical foundations of cost-effectiveness analysis, has attractive internal consistency properties, and is consistent with a simple vector algebra approach to the problem. In contrast, the "mean ratio" approach has not been shown to follow from first
principles, is internally inconsistent, and can prescribe economically inefficient choices. It is concluded that the "ratio of means" procedure should be preferred unless persuasive arguments are presented to the contrary. (Abstract by: Author)


Although economic outcome research is an evolving field in health services research, there are correct and incorrect ways to conduct and report on economic outcome studies. Research practices that help to minimize real or perceived bias will increase the quality and usefulness of such studies for those who sponsor, publish, and use them. Because of public concerns about the potential for bias in the design, analysis, and reporting of economic analyses of health care technology, we formed a task force to develop principles to enhance the credibility of these studies. The Task Force on Principles for Economic Analysis of Health Care Technology included participants from academia, the pharmaceutical industry, the public sector, and private research organizations. This article presents the guidelines developed by this task force.


Decision-makers are interested in measuring the costs and benefits of various interventions, and sometimes they are presented with the average costs and benefits of alternative interventions and asked to compare these. Usually a newer intervention is being compared with an existing one, and the most appropriate comparison is not of average costs (and benefits) but of the extra--or marginal--costs (and benefits) of the new intervention. Reanalysis of the cost effectiveness ratio of biochemical screening of all women for Down's syndrome compared with age based screening shows that the marginal cost effectiveness of biochemical screening is 47,786 pounds, compared with an average cost effectiveness of 37,591 pounds. It may sometimes be difficult or costly to calculate marginal costs and benefits, but this should be done whenever possible. (Abstract by: Author)


A capitation payment arrangement can be an effective means to control health care costs, because it allows both the insurer and the employer to predict costs for health care service a more accurately. This article describes a six-step methodology for developing a capitation payment rate and establishing such arrangements. The six step are: (1) determine the delivery system cost base, (2) develop use rates, (3) calculate capitation rates, (4) adjust rates for impact of incremental volume, (5) negotiate the contract, and (6) monitor performance.


In medicine, reimbursement changes that block cost shifting are rendering revenue-based strategies less productive. Under these conditions, cost-benefit and cost-effective analyses are being touted as more effective financial tools. The anesthesia literature reflects misunderstanding and misapplication of the terminology, and principles of cost analysis are reviewed in this essay. Current evidence suggests that anesthesia costs are a minor part of the problem of controlling health care expenditures. However, the ability to perform cost analysis is essential for anesthesia groups to secure their position in health care. (Abstract by: Author)

This article examines the costs associated with quality in health care delivery. A model applicable to health care settings is specified according to investments in quality and the cost of not achieving quality. The premises and basic theories underlying the model are explored. The model was developed at Lovelace Health Systems in Albuquerque, New Mexico, as a decision making tool. The specific cost elements comprising the quality cost model are identified and illustrated using the working model adopted at Lovelace. The managerial impact of the quality cost model and the implications for other health care organizations are examined.


The quality-adjusted life-year, an economic tool for allocating health care resources, lets researchers compare the cost-effectiveness of different therapies for virtually any disease. It purports to describe quantity of life, with an adjustment for quality of life, as a function of financial cost. Its goal is to maximize health care efficiency, but its methodology does not adequately meet the needs of older patients. (Abstract by: Author)


This article addresses three issues in interpreting cost-effectiveness ratios and in translating them into criteria.


Cost-effectiveness analysis (CEA) is a method of economic evaluation that can be used to assess the efficiency with which health care technologies used limited resources to produce health outputs. However, inconsistencies in the way that such ratios are constructed often lead to misleading conclusions when CEs are compared. Some of these inconsistencies, such as failure to discount or to calculate incremental ratios correctly, reflect analytical errors that, if corrected, would resolve the inconsistencies. Others reflect fundamental differences in the viewpoint of the analysis. The perspectives of different decision-making entities can properly lead to different items in the numerator and denominator of the cost-effectiveness (C/E) ratio. Producers and consumers of CEA need to be more conscious of the perspectives of analysis, so that C/E comparisons from a given perspective are based upon a common understanding of the elements that are properly included.


This paper begins with an examination of the five categories of resource costs and health consequences. They demonstrate that the recommendations of the US Panel capture each of these, without double counting. In the process, however, they point out that there may be many available measures of these outcomes, leading to opportunities for double counting. They conclude that there is more concordance between their approach and another than they themselves recognize, but that there are differences also. (Abstract by: Author)


OBJECTIVE: To develop consensus-based recommendations for the conduct of cost-effectiveness analysis (CEA). This article, the second in a 3-part series, describes the basis for
recommendations constituting the reference case analysis, the set of practices developed to
guide CEAs that inform societal resource allocation decisions, and the content of these
recommendations. PARTICIPANTS: The Panel on Cost-Effectiveness in Health and Medicine,
a nonfederal panel with expertise in CEA, clinical medicine, ethics, and health outcomes
measurement, was convened by the US Public Health Service (PHS). EVIDENCE: The panel
reviewed the theoretical foundations of CEA, current practices, and alternative methods used in
analyses. Recommendations were developed on the basis of theory where possible, but
tempered by ethical and pragmatic considerations, as well as the needs of users.
CONSENSUS PROCESS: The panel developed recommendations through 2 1/2 years of
discussions. Comments on preliminary drafts prepared by panel working groups were solicited
from federal government methodologists, health agency officials, and academic methodologists.
CONCLUSIONS: The panel's methodological recommendations address (1) components
belonging in the numerator and denominator of a cost-effectiveness (C/E) ratio; (2) measuring
resource use in the numerator of a C/E ratio; (3) valuing health consequences in the
denominator of a C/E ratio; (4) estimating effectiveness of interventions; (5) incorporating time
preference and discounting; and (6) handling uncertainty. Recommendations are subject to the
rule of reason; balancing the burden engendered by a practice with its importance to a study.
If researchers follow a standard set of methods in CEA, the quality and comparability of studies,
and their ultimate utility, can be much improved. (Abstract by: Author)


There is a growing international concern about increasing asthma morbidity. While
much is known about asthma morbidity, there are few available data on the economic burden of
this condition, particularly in underdeveloped countries. In the absence of data on social costs,
it is not possible to develop rational approaches to policies regarding resource allocation to
reduce morbidity. The purpose of this article is to provide a review of the available literature on
the social costs of illness for asthma. In light of this literature, we propose a conceptual model
that links asthma morbidity to the social opportunity costs of the disease. We then delineate a
framework, based on the proposed model, that can be used to conceptualize and evaluate the
relative impact of alternative asthma intervention strategies. Based upon proposed analyses
using this model, we believe that it would be possible to compare how various intervention
strategies are likely to affect asthma costs and morbidity, thus providing a means for a more
rational approach to healthcare policies regarding societal resource allocation for asthma.
(Abstract by: Author)

Wiewel, W., J. Persky, et al. (1995). “Are Subsidies Worth It? How to Calculate the Costs and

A cost-benefit spreadsheet based on an econometric model of the local economy is
being used by analysts in Chicago's Department of Planning and Development to improve the
economic and fiscal information available for making decisions about business subsidies. At its
most basic level, cost-benefit analysis compares two situations: the city with the project and the
city without the project. For Chicago, the cost-benefit analyses was built around simulations
from the model developed by Regional Economic Modeling Inc.(REMI).

7-11.

Many clinicians believe that allowing costs to influence clinical decisions is unethical.
They are mistaken in this belief, because is cannot be ethical to ignore the adverse
consequences upon others of the decisions you make, which is what “costs” represent. There
are, however, some important ethical issues in deciding what costs to count, and how to count
them. But these dilemmas are equally strong with respect to what benefits to count and how to count them, some of which expose ethically untenable assumptions about such widely-used clinical criteria as survival rates. One of the advantages of systematic cost-effectiveness analysis is that it exposes these hidden assumptions, and requires explicit judgements to be made about which ethical position is appropriate in a particular policy context. This should have the important incidental benefit of improving the accountability of policy-makers to the community they are serving.


OBJECTIVE: The authors examined different ways of measuring unit costs and how methodological assumptions can affect the magnitude of cost estimates and the ratio of treatment costs in comparative studies of mental health interventions. Four methodological choices may bias cost estimates: study perspective, definition of the opportunity cost of resources, cost allocation rules, and measurement of service units. METHOD: Unit costs for outpatient services, individual therapy, and group therapy were calculated under different assumptions for a single community mental health center (CMHC). Using hypothetical service utilization profiles, the authors used the unit costs to calculate the costs of mental health treatments provided by two programs of the CMHC. RESULTS: The unit costs for an hour of outpatient services ranged from $108 to $538. The unit costs for an hour of therapy varied by 156%; unit costs were lowest if the management perspective was assumed and highest if the economist perspective was assumed. The ratio of the outpatient costs in the two treatment programs ranged from 0.6 to 1.8. CONCLUSIONS: The potential errors introduced by methodological choices can bias cost-effectiveness findings based on randomized control trials. These errors go undetected because crucial methodological information is not reported. (Abstract by: Author)


This article provides an introduction to the theory, practice, and use of CBA and CEA in the medical setting. The objective is to provide the readers with the background necessary to critique the many analyses appearing in the medical care literature and to participate in such research. We will (a) offer a brief introduction to illustrate the similarities and differences between CBA and CEA; (b) describe methods to measure cost, benefits, outcomes, and utilities; (c) briefly discuss the role of medical decision analysis in CBA and CEA; and (d) address the potential applications and limitations of CBA and CEA.


BACKGROUND: Researchers are increasingly interested in examining costs of care, and large administrative and clinical databases have made relevant data readily available. Because a few patients incur high costs relative to most patients, the distribution of cost data is often skewed. How robust are the usual methods of cost analysis against the skewed distribution of cost data? OBJECTIVE: To determine the methods commonly used for comparing cost data, describe their limitations, and provide an alternate method of analysis. DESIGN: Review of statistical methods used in studies of medical costs published in medical journals between January 1991 and January 1996. Description of a Z-score method appropriate for testing the equality of mean costs between two log-normal samples; and reanalysis of published two-sample comparison results done by using the Z-score method. RESULTS: For two-sample comparisons, three methods were commonly used: the Student t-test on untransformed costs, the Wilcoxon test on untransformed costs, and the Student t-test.
on log-transformed costs. The t-test on untransformed costs ignores the skewness in cost data, the Wilcoxon test ignores unequal variances, and the t-test on log-transformed costs tests the wrong null hypothesis unless variances in the log-scale are equal. Eleven articles included two-sample tests and had enough information to allow reanalysis of the data using the Z-score method. These articles described a total of 23 Wilcoxon tests and 24 t-tests on untransformed costs. Most results did not change on reanalysis, but six results changed enough to alter conclusions. Specifically, reanalysis of data for which one Wilcoxon test had shown statistically significant results showed nonsignificant results; reanalysis of data for which two Wilcoxon tests had shown nonsignificant results showed statistically significant results. In articles that used t-tests on untransformed costs, two statistically significant results became nonsignificant on reanalysis and one nonsignificant result became statistically significant on reanalysis. CONCLUSIONS: The methods commonly used to compare costs of two groups have limitations. Some limitations may change some conclusions, and the direction of the change cannot be predicted. The Z-score method is designed to adjust for skewness in cost data and is appropriate for comparing means of log-normally distributed cost data. (Abstract by: Author)


The purpose of this article is to provide the reader with an overview of cost-benefit analysis as it relates to diagnostic radiology.

**General Methodology**


This chapter concludes the book with an illustration in which effectiveness, efficiency, and equity research are applied in a prospective evaluation of universal health insurance alternatives. The major provisions of three diverse UHI proposals are described, and their projected consequences are evaluated. The analysis is patterned after analyses that have appeared in the health services literature at other times when national health reform appeared to be just around the corner. (Abstract by Author)


One widely discussed response to the severe problems faced by many rural hospitals is to convert them into organizations that provide health services other than general, acute inpatient care. This study identifies conversions that occurred nationally from 1984 to 1991. The study also empirically examines the determinants of conversion, using rural hospitals that did not convert (between 1984 and 1991) as a comparison group. The authors examine a set of factors that makes radical organizational change necessary (eg, poor performance) and reduces resistance to such change (eg, proximity to other hospitals). Results from discrete-time logistic regression show that converters are more likely than nonconverters to: have poor performance and fewer beds; be located very near to or very distant from similar hospitals; operate in larger communities; devote more of their care to areas other than acute inpatient care; and be members of multihospital systems. Converters also are less likely to be government owned. The need for future research on the effects of conversion is discussed.

Most physicians have long felt that there must be a better way to address the need for improving the cost effectiveness of medical care other than the process-heavy, invasive tactics of traditional UR. The QE strategy of replacing case-by-case pretreatment authorizations and certifications with a more thorough retrospective analysis of medical practice patterns appears to have the potential to dramatically improve managed care results while minimizing many of the more irritating aspects of traditional UR. The QE managed care strategy has much to offer the manager of a medical group practice who has come to realize the importance of demonstrating superior quality and efficiency as a way out of the "price discounting" game. (Abstract by: Author)


Over the last few years, the pharmaceutical industry has financed an increasing number of health economic evaluations. The purpose of this article is to describe how and why the pharmaceutical industry is applying health economic evaluations. Seven different fields of application are identified, and the varying reasons for use are discussed.


Changes in rural health care are resulting in new challenges for the administrators of rural hospitals. The lack of available care, economic deterioration, and demographic changes in rural America are contributing factors to rural health care problems and are detrimental to the financial well-being of rural hospitals. Diversification is becoming commonplace in these hospitals as administrators seek strategies to gain financial viability for their facilities. The concept of hospital-sponsored rural health clinics is more than a decade old, yet there are fewer than 30 such clinics nationwide. Reasons for the underutilization of such clinics may include the lack of knowledge that such clinics exist as well as inadequate information describing the establishment, operation, and financial feasibility of the clinics. The hospital-sponsored rural health clinic "concept" will be introduced, including potential benefits of such clinics to both the hospital and the communities they serve, factors to be considered in developing such a system, and problems that may arise in this development. This article presents a case study of how one rural hospital incorporated such clinics into its long-range plans. (Abstract by: Author)


This paper reviews and compares existing statistical methods for profiling health care providers. It recommends improvements that are based on the use of better statistical models and the adoption of more realistic, medically based criteria for judging the performance of health care providers. Unlike most profiling methods, the proposed hierarchical models allow the probability of acceptable provider performance to be calculated; thus, they can answer such questions as, "What is the probability that a given hospital's true mortality rate for cardiac surgery patients exceeded 3.33% last year?" The commonly encountered problems of regression-to-the-mean bias and small caseloads can be handled by using hierarchical models to extract more information from profiling data. (Abstract by: Author)

Estimates of the contribution hospitals make to rural community incomes, as well as the implications of these estimates for recent health policy initiatives are discussed in this article. The range of problems that presently confront rural hospitals motivated the analysis of these estimates.


Not all rural hospitals are in a depressed financial situation. Many can and have achieved financial performance levels, which match their urban counterparts. Cost control is the single most important management strategy, which differentiates the successful from the unsuccessful rural hospital. Labor productivity is much higher in the financially successful rural hospital than in the unsuccessful hospitals. Reduced length of stay is also especially critical in the overall cost containment program. (Abstract by: Author)


Expected utility theory is felt by its proponents to be a normative theory of decision making under uncertainty. The theory starts with some simple axioms that are held to be rules that any rational person would follow. It can be shown that if one adheres to these axioms, a numerical quantity, generally referred to as utility, can be assigned to each possible outcome, with the preferred course of action being that which has the highest expected utility. One of these axioms, the independence principle, is controversial, and is frequently violated in experimental situations. Proponents of the theory hold that these violations are irrational. The independence principle is simply an axiom dictating consistency among preferences, in that it dictates that a rational agent should hold a specified preference given another stated preference. When applied to preferences between lotteries, the independence principle can be demonstrated to be a rule that is followed only when preferences are formed in a particular way. The logic of expected utility theory is that this demonstration proves that preferences should be formed in this way. An alternative interpretation is that this demonstration proves that preferences should be formed in this way. An alternative interpretation is that this demonstrates that the independence principle is not a valid general rule of consistency, but in particular, is a rule that must be followed if one is to consistently apply the decision rule “choose the lottery that has the highest expected utility.” This decision rule must be justified on its own terms as a valid rule of rationality by demonstration that violation would lead to decisions that conflict with the decision maker’s goals. This rule does not appear to be suitable for medical decisions because often these are one-time decisions in which expectation, a long-run property of a random variable, would not seem to be applicable. This is particularly true for those decisions involving a non-trivial risk of death. (Abstract by: Author)


Consultation represents the act of providing advice regarding diagnosis and/or management and may comprise a major component of a cardiologist’s practice. A frequent cause for cardiac consultation is preoperative risk assessment. With steadily decreasing morbidity and mortality related to noncardiac surgery, cardiovascular management strategies that are known to improve long-term outcomes should guide decision making in the perioperative setting. The preoperative cardiac consultation may represent an opportunity to initiate or modify cardiac care including primary and secondary preventive measures. A stepwise approach to perioperative cardiac risk assessment, as set forth by joint American College of Cardiology and American Heart Association guidelines, should be employed. The
hallmark of successful preoperative cardiology consultation is effective communication with referring physicians. A consultant's good clinical judgement will only impact a patient's care if recommendations are communicated effectively. There is no substitution for direct, verbal contact. Recommendations should be kept to less than five when possible, be brief and specific. The consultant should provide contingency plans and follow-up. Good consultative technique increases compliance with recommendations and facilitates efficient patient care. (Abstract by: Author)


The recurring decision of selecting among potential knowledge resources was modeled as a cost-benefit tradeoff, with associated observable features. Internal medicine and community family practice physicians (n = 228) completed a self-administered questionnaire designed to elicit reported use and cost-benefit features of nine knowledge resources. The subjects reported most frequent use of clinical colleagues, intermediate use of textbooks and journals, and least use of indexing systems. Resources' benefit-related qualities (extensiveness and credibility) were not related to reported use. In contrast, the model's access cost variables (availability, searchability, understandability, and clinical applicability) were significantly related to use. Results were generally favorable to the model's framework of knowledge resource selection. Multiple linear regression analysis suggested that physicians' use of clinical knowledge resources could be described by the physician's level of training, availability, applicability, and the resource medium (colleague, index, or text/journal). (Abstract by: Author)


This article discuses through example, a methodology for applying clinical trial results to patient treatment.


The wider use of computers for the management of endoscopic data and the use of electronic endoscopes for the production of high quality endoscopic images has made the standardization of terminology and images formats necessary in digestive endoscopy reports. The European Society for Gastrointestinal Endoscopy and the American Society for Gastrointestinal Endoscopy have combined their efforts to propose a Minimal Standard Terminology for Computerized Databases in Endoscopy. This terminology is based on the following principles: no term describing findings less frequent than 1%, of the daily practice, and no term based on subjective impressions. The Minimal Standard Terminology has been developed according to the natural process of constructing an endoscopic report in natural language and deals with the following: reasons for performing the examination, endoscopic findings, endoscopic diagnosis, additional therapeutic and diagnosis procedures (biopsies, etc.). It is subdivided according to the main organs examined with an endoscopy. Until now, the Minimal Standard Terminology was tested in many centers and was shown to accurately cover 95% of routine examinations for the upper gastrointestinal tract, colonoscopy and cholangio-pancreatography. It is currently being tested in an a prospective way in several centers in Europe (with a grant from the European Commission DGXIII-C4) and in the USA (with grant from the AHDHF). (Abstract by: Author)

This research illustrates the importance of a hospital to the economic health of a community. A simulation model of a rural community in Oklahoma is used to demonstrate how the implementation of the DRG reimbursement policy has impacted a rural community, and to project how the closing of the hospital would impact the economy of the community. The results indicate that rural hospitals play a vital role in the economics of their communities, while the DRG reimbursement policy has had a significant impact on the community.


A major concern to the rural citizens of the United States is the availability of health care in their community. Community leaders and physicians considering locating in rural communities need a method by which they can evaluate a community's potential for supporting a physician. A detailed survey was conducted in 1986 of 25 physicians' practices in rural Oklahoma. Data were collected from the physicians on their number of patient visits and practice costs in 1985. Using this information, the authors designed a model to project the economic feasibility of establishing a physician practice in a specific community. This model can be used to project the number of physician visits a community can generate, the costs to establish and maintain a clinic, and the gross and net income of the practice.


With the growing international literature in economic evaluation and the rapid spread of new health technologies, there is a need to undertake, or at least interpret, economic evaluations on the international level. However, the ways in which cross-national differences affect the cost-effectiveness of health technologies or their evaluations have never been studied. This paper explores these issues by taking advantage of a unique situation in which the same economic evaluation of a new indication for a health technology was conducted simultaneously in four countries using an identical methodology. The study showed that if prior agreement on methods can be reached and local data applied, economic evaluations can be undertaken in a way that facilitates the extrapolation of results from country to country.


This article outlines some of the threats to validity in economic evaluations using three organizing questions that appear in other articles in this series of users’ guides:
1. Are the results valid?
2. What were the results?
3. Will the results help in caring for my patients?


Authors found that nurses differed in their preferences for decision-making autonomy in three types of work-related decisions. Employed nurses with a greater preference for autonomy were more satisfied with their jobs, and those with little or no such preference were less satisfied, as they gained decision-making influence over patient care and unit management. The authors discuss implications for designing and implementing decision-making programs. (Abstract by: Author)

Using data from the National Survey of Families and Households, the Survey of Income and Program Participation, and the National Health Interview Survey, this article estimates the structural impact of income on the following measures of health: self-assessed health status, work and functional limitations, bed days, average daily consumption of alcohol, and scales of depressive symptoms and alcoholic behavior. Both ordinary and IV estimates indicate that increases in income significantly improve mental and physical health but increase the prevalence of alcohol consumption. Cost-benefit analyses of government policies that may reduce disposable income should take into account potential effects on morbidity. (Abstract by: Author)


The objective of this research is to examine the role of one of the largest consumer services sectors--the hospital industry--in interregional trade and to assess its impact on a regional economy. The analysis demonstrates the export share revenue, the extent of local purchasing, and the income and employment generating capacity of the hospital sector in a large metropolitan area.


This article covers the following topics regarding telemedicine and medical practice regulation:
I. Legislative findings and purpose
II. Definition
III. Licensure
IV. Patient Medical Records
V. Exemptions
VI. Sanctions

The topics are also explored within the context of a proposed act to regulate the practice of medicine across state lines.


Primary health care centers have been proposed to meet the health care needs of rural America. Some centers become financially "self-sufficient", receiving their entire budgets from direct patient or third-party payments; others shut down when external funding is withdrawn. An explanation for this difference is important, because funding agencies may not wish to subsidize centers whose financial futures appear bleak. This study identifies the correlates of financial self-sufficiency. A survey conducted in late 1976 or 164 rural clinics provided 101 usable responses. Multiple regression analysis of the data shows that the longer a center has been in operation, the more self-sufficient it will become. Hospital control of the center and provision of laboratory tests increase self-sufficiency; outreach services and nonprofit status reduce it. Two variables related to financial self-sufficiency are separately examined. Clinics with a faster growth rate of patient visits are more self-sufficient, and smaller clinics tend to grow faster. More self-sufficient clinics experience less difficulty in keeping professional staff. The presence of a state Area Health Education Center (AHEC) program also eases the problem of staff retention. (Abstract by: Author)

Recently, the authors used the results from the Rand Health Insurance Experiment (1987) to estimate the welfare loss of excess health insurance. Their findings indicated that the loss was very large--between $33.4 and $61.0 billion annually, at 1984 prices. The reasoning behind their findings contends that the marginal costs of services is unaffected by insurance and that the extra services consumed as a result of free medical care have less value than their cost to society. This article is in response to a critique (Rice, 1992) the authors received questioning the relevance of the suggested downward-sloping demand curve for medical care for welfare analysis. The authors also note some problems that arise with using Rice’s alternative framework based on researchers’ evaluations of medical necessity.


Sensitivity analysis has traditionally been applied to decision models to quantify the stability of a preferred alternative to parametric variation. In the health literature, sensitivity measures have traditionally been based upon distance metrics, payoff variations and probability measures. We advocate a new approach based on information value and argue that such an approach is better suited to address the decision-maker’s real concerns. We provide an example comparing conventional sensitivity analysis to one based on information value.


Key decisions regarding the introduction and optimal use of health technologies often are made on an ad hoc basis. Quantitative information on effectiveness, if incorporated into the decision-making process, would establish a reasoned and defensible basis for the introduction and optimal use of therapeutic technologies. Utility measures provide a single summary score of effectiveness which, when combined with cost information, permits the calculation of cost-utility ratios for alternative technologies. A number of techniques have been developed to elicit utilities, including standard gamble, time trade-off, rating scales, the Quality of Well-Being Scale, and the Health Utility Index. No single method has been accepted yet as the gold standard. Selection therefore must be guided by the specific objectives of the assessment. (Abstract by: Author)


Internal medicine is confronting a conflict between its generalist and specialty roles, coupled with a conflict between the needs of academic internal medicine in contrast to those of private practice. The historical origins of these conflicts are explored. To resolve these conflicts, internal medicine must rediscover the common ground shared by the general internist and specialist, academician and practitioner. This common ground is best found in the role of internist as physician-scientist. In the future, specialists and general internists will need to emphasize their roles as consultants. In the process, internal medicine will become smaller and more "academic." The benefits of this role for internal medicine should be rapidly demonstrated through outcomes based research in order to win over skeptical payors, peers, and the public at large.


Little is known about referral patterns to the allergist for hay fever. In a system with open access to the specialist, we investigated the reasons for consulting an allergist in 126 patients.
who completed a questionnaire on their first visit. Both sexes were equally represented, the median age was 29 years, the duration of the disease and the duration of seasonal symptoms were 9 years and 10 weeks (median), respectively, and 54% of patients reported a history suggestive of asthma. The symptoms were highly variable; on average, 5.6 on a 10-cm visual analog scale. Most of the patients (94%) had been treated for hay fever before. Only 30% were referred by another physician, the rest being self-referred. The reasons for referral were investigated. The overall motivation to consult was related to symptom severity in 63% of the patients; 37% consulted for other reasons, including an expectation of greater "know-how" on the part of the allergist concerning specific diagnosis, treatment, and advice or counseling. The stimulus triggering the consultation was clearly not related to symptoms or disease in 25% of the cases. We conclude from these data that many patients are clearly interested in benefiting from the professional skill of a fully trained allergist.


Many questions must be addressed before telemedicine services can be extended across the nation. The variances in state laws regarding licensure frustrates telemedicine practitioners. Current consultation exceptions may or may not be applicable to the practice of telemedicine. Unless and until states agree on common standards for licensure, as they already have for examination, practitioners of telemedicine will be subject to the rules of the separate states.


OBJECTIVE: To determine which attributes of clinical practice guidelines influence the use of guidelines in decision making in clinical practice. DESIGN: Observational study relating the use of 47 different recommendations from 10 national clinical guidelines to 12 different attributes of clinical guidelines—for example, evidence based, controversial, concrete. SETTING: General practice in the Netherlands. SUBJECTS: 61 general practitioners who made 12 880 decisions in their contacts with patients. MAIN OUTCOME MEASURES: Compliance of decisions with clinical guidelines according to the attribute of the guideline. RESULTS: Recommendations were followed in, on average, 61% (7915/12 880) of the decisions. Controversial recommendations were followed in 35% (886/2497) of decisions and non-controversial recommendations in 68% (7029/10 383) of decisions. Vague and non-specific recommendations were followed in 36% (826/2280) of decisions and clear recommendations in 67% (7089/10 600) of decisions. Recommendations that demanded a change in existing practice routines were followed in 44% (1278/2912) of decisions and those that did not in 67% (6637/9968) of decisions. Evidence based recommendations were used more than recommendations for practice that were not based on research evidence (71% (2745/3841) v 57% (5170/9039)). CONCLUSIONS: People and organizations setting evidence based clinical practice guidelines should take into account some of the other important attributes of effective recommendations for clinical practice. (Abstract by: Author)


In the first of a series of four articles the authors explain the statistical concepts of hypothesis testing and p values. In many clinical trials investigators test a null hypothesis that there is no difference between a new treatment and a placebo or between two treatments. The result of a single experiment will almost always show some difference between the experimental and the control groups. Is the difference due to chance, or is it large enough to reject the null hypothesis and conclude that there is a true difference in treatment effects? Statistical tests
yield a p value: the probability that the experiment would show a difference as great or greater than that observed if the null hypothesis were true. By convention, p values of less than 0.05 are considered statistically significant, and investigators conclude that there is a real difference. However, the smaller the sample size, the greater the chance of erroneously concluding that the experimental treatment does not differ from the control—in statistical terms, the power of the test may be inadequate. Tests of several outcomes from one set of data may lead to an erroneous conclusion that an outcome is significant if the joint probability of the outcomes is not taken into account. Hypothesis testing has limitations, which will be discussed in the next article in the series.


In the second of four articles, the authors discuss the "estimation" approach to interpreting study results. Whereas, in hypothesis testing, study results lead the reader to reject or accept a null hypothesis, in estimation the reader can assess whether a result is strong or weak, definitive or not. A confidence interval, based on the observed result and the size of the sample, is calculated. It provides a range of probabilities within which the true probability would lie 95% or 90% of the time, depending on the precision desired. It also provides a way of determining whether the sample is large enough to make the trial definitive. If the lower boundary of a confidence interval is above the threshold considered clinically significant, then the trial is positive and definitive, if the lower boundary is somewhat below the threshold, the trial is positive, but studies with larger samples are needed. Similarly, if the upper boundary of a confidence interval is below the threshold considered significant, the trial is negative and definitive. However, a negative result with a confidence interval that crosses the threshold means that trials with larger samples are needed to make a definitive determination of clinical importance.


See Jaeschke, R. G.


Correlation and regression help us to understand the relation between variables and to predict patients' status in regard to a particular variable of interest. Correlation examines the strength of the relation between two variables, neither of which is considered the variable one is trying to predict (the target variable). Regression analysis examines the ability of one or more factors, called independent variables, to predict a patient's status in regard to the target or dependent variable. Independent and dependent variables may be continuous (taking a wide range of values) or binary (dichotomous, yielding yes-or-no results). Regression models can be used to construct clinical prediction rules that help to guide clinical decisions. In considering regression and correlation, clinicians should pay more attention to the magnitude of the correlation or the predictive power of the regression than to whether the relation is statistically significant.


Reliability, the ratio of the variance attributable to true differences among subjects to the total variance, is an important attribute of psychometric measures. However, it is possible for instruments to be reliable, but unresponsive to change; conversely, they may show poor reliability but excellent responsiveness. This is especially true for instruments in which items
are tailored to the individual respondent. Therefore, we suggest a new index of responsiveness to assess the usefulness of instruments designed to measure change over time. This statistic, which relates the minimal clinically important difference to the variability in stable subjects, has direct sample size implications. Responsiveness should join reliability and validity as necessary requirements for instruments designed primarily to measure change over time. (Abstract by: Author)


Clinicians and policymakers are recognizing the importance of measuring health related quality of life (HRQL) to inform patient management and policy decisions. Self or interviewer administered questionnaires can be used to measure cross sectional differences in quality of life between patients at a point in time (discriminative instruments) or longitudinal changes in HRQL within patients over time (evaluative instruments). Both discriminative and evaluative instruments must be valid (really measuring what they are supposed to measure) and have a high ratio of signal to noise (reliability and responsiveness, respectively). Reliable discriminative instruments are able to reproducibly differentiate between persons. Responsive evaluative measures are able to detect important changes in HRQL over time, even if those changes are small. HRQL should be interpretable—that is, clinicians and policymakers must be able to identify differences in scores that correspond to trivial, small, moderate, and large differences.

Two basic approaches to quality of life measurement are available: generic instruments that attempt to provide a summary of health related quality of life; and specific instruments that focus on problems associated with individual disease states, patient groups, or areas of function. Generic instruments include health profiles and instruments that generate health utilities. The approaches are not mutually exclusive. Each approach has its strengths and weaknesses and may be suitable under different circumstances. Investigations in HRQL have led to instruments suitable for detecting minimally important effects in clinical trials, measuring the health of populations, and for providing information for policy decisions.


This article is an overview of the series of articles that serve as guides for readers of medical literature (particularly physicians who must keep up-to-date in their clinical disciplines and find the best way to manage a particular clinical problem).


See Oxman, A.D.


The article addresses the following issues: Are the results of the study valid? Primary Guides: Was the assignment of patients to treatments randomized? Were all patients who entered the trial properly accounted for and attributed at its conclusions? Was follow-up complete? Were patients analyzed in the groups to which they were randomized? Secondary Guides: Were patients, health workers, and study personnel "blind" to treatment? Were the groups similar at the start of the trial? Aside from the experimental intervention, were the groups treated equally?

Provides a clinical scenario, in an effort to better explain how to use medical literature, more specifically an article about therapy or prevention, when caring for patients.


See Jaeschke, R.G.


See Jaeschke R.G.


See Levine, M.


See Laupacis, A.


See Oxman, A.D.


See Richardson, W.S.


See Richardson, W.S.


See Hayward, R.


See Richardson, W.S.

See Wilson, M.


The article offers criteria by which readers of medical literature can evaluate health care recommendations. Previous criteria for grading recommendations are reviewed, and a suggested framework for today’s literature outlines the following components: 1. The strength of the evidence. 2. How big and impact of treatment warrants its use? 3. How much does the treatment work? The final product is recommendations.


See Naylor, C.D.


See Naylor, C.D.


The article addresses the following issues: Are the results valid? Have the investigators measured aspects of patients’ lives that patients consider important? Did the HRQL instruments work in the way they are supposed to? Are there important aspects of HRQL that have been omitted? If there were trade-offs between quality and quantity of life, or an economic evaluation, have the investigators used the right measures? What were the results? What was the magnitude of effect on HRQL? Will the results help me in caring for my patients? Will the information from the study help me inform my patients? Did the study design simulate clinical practice?


See Drummond, M.F.


See O’Brien, B.


See Dans, A.L.


See Richardson, W. S.

The purpose of this framework is to distinguish between three fundamental measurement applications which require different approaches for assessing reliability and validity.


Most new diagnostic technologies have not been adequately assessed to determine whether their application improves health. Comprehensive evaluation of diagnostic technologies includes establishing technologic capability and determining the range of possible uses, diagnostic accuracy, impact on the health care provider, therapeutic impact and impact on patient outcome. Guidelines to determine whether each of these criteria have been met adequately are presented. Diagnostic technologies should be disseminated only if they are less expensive, produce fewer untoward effects and are at least as accurate as existing methods, if they eliminate the need for other investigations without loss of accuracy, or if they lead to institution of effective therapy. Establishing patient benefit often requires a randomized controlled trial in which patients receive the new test or an alternative diagnostic strategy. Other study designs are logistically less difficult but may not provide accurate assessment of benefit. Rigorous assessment of diagnostic technologies is needed for efficient use of health care resources.


OBJECTIVE. This study evaluates the relationship between hospital and regional characteristics and the prevalence of mobile computed tomography in rural hospitals. DATA SOURCES AND STUDY SETTING. Primary data were gathered from all rural hospitals in eight northwestern states (n = 471) in 1991. Secondary data sources include the AHA Annual Survey, the Area Resource File, and HCFA's PPS data sets for 1987-1990. STUDY DESIGN. Primary data are a single observation taken in the summer of 1991. Key hospital characteristics include patient volume, distance to the nearest referral center, distance to the nearest hospital, financial performance, and medical staff size. Key regional variables include beds per unit area, hospitals per unit area, and physician supply. DATA COLLECTION. A structured telephone interview was conducted with the hospital administrator at each hospital. For many hospitals, detailed information was gathered with additional calls to hospital personnel. PRINCIPAL FINDINGS. Where hospitals are closely spaced, mobile CT suppliers are more readily available, and hospitals are more likely to choose mobile CT than in areas where hospitals are farther apart. Hospitals may realize economies of scale and scope in their decisions about CT adoption. CONCLUSIONS. Transportation costs are an important determinant of hospital decisions about acquiring CT, but may be less important for higher-priced medical technologies. There is no support for the proposition that rural hospitals compete with referral centers for patients by purchasing technological equipment. (Abstract by: Author)


Patient care is often outmoded because physicians lack awareness about important advances in medical knowledge. According to physicians, reading journals is the most popular method for staying informed, but the great volume of journal literature precludes clinicians’ from reading all of it. In this first of six articles on keeping up with the medical literature, we describe three strategies to enhance the efficiency and effectiveness of journal reading. First, priority should be given to reading original articles concerning reports of planned investigations
because only these articles provide sufficient details to assess the relevance, validity, and clinical application of new knowledge. Second, reading should be restricted to articles of direct pertinence to one's clinical practice. Third, the methods section of articles should be quickly screened first to select studies that have used sufficiently high standards to warrant clinical action based on study results.


For practitioners, one of the major objectives for reading the medical literature is to maintain clinical competence. Ideally, this task is accomplished through efficiently extracting from the literature properly validated advances in medical knowledge of direct relevance to the reader's own practice. Practically, the extraction process is a difficult one because reports describing such advances are disseminated through a multitude of general and specialty journals. We describe a preemptive strategy for clinicians to determine which journals to read on a regular basis. General and specialty journals of potential relevance to the reader's practice should be selected initially on the basis of circulation or citation impact, and then consecutive issues surveyed to determine the journals' yields of articles that are both directly relevant and of high quality. Subsequent reading should concentrate on the journals that produce the highest yield on this personal survey. (Abstract by: Author)


Clinicians can derive immense satisfaction from keeping abreast of new developments in patient care by regularly scanning the medical journal literature. Combined with good reading habits and self-discipline, this scanning generally can be accomplished within the time that most practitioners allot to attempting to keep up to date. We describe tactics for formulating a personalized journal-reading list and ensuring access to the key articles in one's field at a reasonable cost. These tactics begin with deleting low-yield journals from regular reading and adding journals more relevant to one's interests. The cost of multiple journal subscriptions can be reduced by circulating different journals among colleagues or by regular visits to the library. These tactics can be supplemented or replaced by using Current Contents or the Selective Dissemination of Information service of the National Library of Medicine and other database vendors. (Abstract by: Author)


Ideally, searches for published articles to solve clinical problems should lead to the best evidence on a given topic quickly and at reasonable expense. This goal can be achieved with modern information skills, sources, and services. In this article, we describe and compare various means, from textbooks to computers, that provide access to information of potential value in addressing clinical problems as they arise. Using the problem of understanding and controlling the risk for the acquired immunodeficiency syndrome among personnel of a community hospital, we examined the following sources for their utility in locating journal literature: general and specialty medical texts, personal reprint collections, expert clinicians, recent journal issues, library textbook collections, the Index Medicus "Bibliography of Reviews" and subject index, and MEDLINE computer searching. For this problem, Index Medicus and MEDLINE were the best sources of up-to-date articles, but MEDLINE was three times as fast. (Abstract by: Author)
Access to the medical literature through personal computers is now readily available and can greatly reduce logistical barriers to using recently published journal articles to support clinical decisions. In this article, we describe many of the options available to clinicians who wish to do their own computer searching of MEDLINE, the largest of the electronic services for the biomedical literature. The "bare bones" computer equipment needed includes a terminal or personal computer, a modern and telephone line, and a printer. Access to MEDLINE is then gained through subscribing to any of a burgeoning number of database vendors. A comparison of 17 permutations and combinations of software and vendors shows that the software and vendors vary substantially in efficiency, cost, and ease of use. Direct subscription to MEDLINE is least expensive, PaperChase is the simplest service to use, and Colleague and Medis provide both MEDLINE access plus full-text journals online. Basic search techniques are illustrated for three clinical problems. (Abstract by: Author)

The human mind is not well suited to storing and retrieving large amounts of infrequently used information. An effective personal filing system is needed if good articles that we encounter in our efforts to keep up to date are to be kept handy for future reference. Many options exist for the creation of a personal filing system. In this article, we assist the reader in the development of a tailor-made system that is based on making key decisions that strike a balance between filing needs and the lack of enthusiasm that most of us have for filing. The complexity of the system should match the number of purposes that your file must serve. Important additional considerations include how much time and effort you are willing to spend; where and how you will house your collection; how many articles you want to keep in the file; what standards you will apply in selecting material for your file; what subject headings are most appropriate for your articles; whether you will need to cross-reference; and what access you will have to personal computers. (Abstract by: Author)

The article addresses the following issues: Are the recommendations valid? Were all important options and outcomes clearly specified? Was an explicit and sensible process used to identify, select and combine evidence? Was an explicit and sensible process used to consider the relative value of different outcomes? Is the guideline likely to account for important recent developments? Has the guideline been subject to peer review and testing?

Holdford presents an overview of the structure of the health care system and its information needs. Steps to building a successful DM alliance are discussed, along with limitations and challenges faced by pharmacists in DM alliances.

Disease management involves a holistic approach in which healthcare professionals work together to effect an optimal outcome for a particular patient with a particular disease. The
environment needed for optimal disease management programs includes a multidisciplinary culture of cooperation, communication and coordination, a clinical champion, an administrative champion, enough time to do disease management correctly, enough support to do it right, computerized information systems, examination of the total patient continuum and not component management, and use of multiple sites to obtain bigger sample sizes. Disease management goes beyond outcomes research, it goes beyond guidelines development, and it goes beyond RCTs. (Abstract by Author)


Physicians must decide when the evidence is sufficient to adopt a new clinical policy. Analysis of large clinical and administrative databases is becoming an important source of evidence for changing clinical policies. Because such analysis cannot control for the effects of all potential confounding variables, physicians risk drawing the wrong conclusion about the cause-and-effect relation between a change in clinical policy and outcomes. Randomized studies offer protection against drawing a conclusion that would lead to adoption of an inferior policy. However, a randomized study may be difficult to justify because of the extra costs of collecting data for a randomized study and concerns that a study will not directly benefit the patients enrolled in the study. This article reviews the advantages and disadvantages of basing clinical policy on analysis of large databases compared with conducting a randomized study. A technique is described and illustrated for accessing the potential costs and benefits of conducting such a study. This type of analysis formed the basis for a physician-managed health care organization deciding to sponsor a randomized study among patients with end-stage renal disease as part of a quality-improvement initiative. (Abstract by: Author)


Although some rural hospitals struggle to remain financially viable, the Internal Revenue Service (IRS) often shows greater flexibility in interpreting regulations for tax-exempt hospitals in rural areas. To take advantage of this flexibility, rural facilities should understand issues affecting Federal tax-exempt status, such as private benefit, private inurement, and unrelated business income. A not-for-profit, rural healthcare facility well versed in tax-exempt regulations and their interpretations by the IRS can structure recruitment and retention programs, joint ventures, unrelated businesses, and even cooperative coalitions to enhance its financial well-being without endangering its tax exemption. (Abstract by: Author)


The article addresses the following issues: Are the results of the study valid? Primary guides: Was there an independent, blind comparison with a reference standard? Did the patient sample include an appropriate spectrum of patients to whom the diagnostic test will be applied in clinical practice? Secondary guides: Did the results of the test being evaluated influence the decision to perform the reference standard? Were the methods for performing the test described in sufficient detail to permit replication?


In the third of a series of four articles the authors show the calculation of measures of association and discuss their usefulness in clinical decision making. From the rates of death or other "events" in experimental and control groups in a clinical trial, we can calculate the relative
risk (RR) of the event after the experimental treatment, expressed as a percentage of the risk without such treatment. The absolute risk reduction (ARR) is the difference in the risk of an event between the groups. The relative risk reduction is the percentage of the baseline risk (the risk of an event in the control patients) removed as a result of therapy. The odds ratio (OR), which is the measure of choice in case-control studies, gives the ratio of the odds of an event in the experimental group to those in the control group. The OR and the RR provide limited information in reporting the results of prospective trials because they do not reflect changes in the baseline risk. The ARR and the number needed to treat, which tells the clinician how many patients need to be treated to prevent one event, reflect both the baseline risk and the relative risk reduction. If the timing of events is important—to determine whether treatment extends life, for example—survival curves are used to show when events occur over time.


The article addresses the following issues:
What are the results? Are likelihood ratios for the test results presented or data necessary for their calculation provided? Will the results help me in caring for my patients? Will the reproducibility of the test result and its interpretation be satisfactory in my setting? Are the results applicable to my patient? Will the results change my management? Will patients be better off as a result of the test?


In this paper the empirical implications of altruism for cost-benefit analysis of projects involving health changes are investigated. It is shown that a willingness-to-pay question allowing the respondent to state her total willingness to pay (irrespective of what reasons she may have for paying), subject to everybody else paying so as to stay at their initial levels of utility, produces, as a special case, the project evaluation rules derived by Jones-Lee (1991, 1992) and others. The implications of alternative formulations of the valuation question in a contingent valuation study are also explored. (Abstract by: Author)


Webster's Dictionary defines a benchmark as 'something that serves as a standard by which others can be measured'. Benchmarking pervades the health care quality improvement literature, and benchmarks are usually based on subjective assessment rather than on measurements derived from data. As such, benchmarks may fail to yield an achievable level of excellence that can be replicated under specific conditions. In this paper, we provide an overview of benchmarking in health care. We then describe the evolution of our data-driven method for identifying an Achievable Benchmark of Care (ABC) on the basis of process-of-care indicators. Here, our experience leads us to postulate the following premises for sound benchmarks: (i) benchmarks should represent a level of excellence; (ii) benchmarks should be demonstrably attainable; (iii) providers with high performance should be selected from among all providers in a predefined way using reliable data; (iv) all providers with high performance levels should contribute to the benchmark level; and (v) providers with high performance levels but small numbers of cases should not unduly influence the level of the benchmark. An example of an ABC applied to the cooperative cardiovascular project leads the reader through the computation of an ABC. Finally, we consider several refinements of the original ABC concept that are in progress, e.g. how to approach the special problems posed by very small denominators. The ABC methodology has been well accepted in multiple quality improvement
projects. This approach lends objectivity and reliability to benchmarks that have been a widely used, but until now, arbitrarily defined tool.


Tests or measures in clinical medicine or the social sciences can be used for three purposes: discriminating between subjects, predicting either prognosis or the results of some other test, and evaluating change over time. The choices made at each stage of constructing a quality of life index will differ depending on the purpose of the instrument. We explore the implications of index purpose for each stage of instrument development: selection of the item pool, item scaling, item reduction, determination of reliability, of validity, and of responsiveness. At many of these stages, not only are the requirements for discriminative, predictive, and evaluative instruments not complementary, they are actually competing. Attention to instrument purpose will clarify the choices both for those developing quality of life measures and for those selecting an appropriate instrument for clinical studies.


Medical and pharmaceutical outcomes research has been of increasing interest in the past 10 to 15 years among healthcare providers, payers, and regulatory agencies. Outcomes research has become a multidisciplinary field involving clinicians, health services researchers, epidemiologists, psychometricians, statisticians, psychologists, sociologists, economists, and ethnicists. Collaboration among researchers in different organizations that offer different types of services and various research expertise is the essential element for any successful outcomes project. In this article we discuss collaboration on outcomes research among academic researchers, managed care organizations, and research-based pharmaceutical manufacturers, with a focus on the opportunities and challenges facing each party. The pharmaceutical industry needs information to make product and promotion decisions; the managed care industry has the data to offer but needs analysis of these data; and pharmacy schools, among other academic institutions, have skilled researchers and data-processing capacity but require projects for revenue, research training, experience, and publications. Challenges do exist with such endeavors, but collaboration could be beneficial in satisfying the needs of individual parties.


The article addresses the following issues: Are the results of the study valid? Primary Guides: Was there a representative and well-defined sample of patients at a similar point in the course of the disease? Was follow-up sufficiently long and complete? Secondary Guides: Were objective and unbiased outcome criteria used? Was there adjustment for important prognostic factors? What are the results? How large is the likelihood of the outcome event(s) in a specified period of time? How precise are the estimates of likelihood? Will the results help me in caring for my patients? Were the study patients similar to my own? Will the results lead directly to selecting or avoiding therapy? Are the results useful for reassuring or counseling patients?


The US healthcare system is evolving from one in which most providers have been paid on some variation of a fee-for-service basis to one in which many or most providers will be paid
on a capitated basis. Will this change in financial incentives make a difference in how coronary artery disease and heart failure are treated and managed? Although the evidence is equivocal and limited, two recent studies suggest that capitation and other global payment incentives may dramatically alter clinical practice patterns in treating cardiovascular disease and substantially reduce cardiac-care costs. Clinical cost-effectiveness research efforts must be intensified. Thought leaders in the field of cardiology must move forcefully in developing, disseminating, and encouraging cardiac-care providers to accept and implement evidence-based clinical practice guidelines. The alternative may be ill-advised tradeoffs decided in a decentralized, competitive marketplace, with algorithms being developed de facto by individual practitioners or groups in response to capitated reimbursement constraints. The resulting practice could reduce healthcare use and spending without being cost-effective. Unexpected and undesirable health outcomes could ensue. (Abstract by: Author)


The article addresses the following issues: Are the results of the study valid? Were there clearly identified comparison groups that were similar with respect to important determinants of outcome, other than the one of interest? Were the outcomes and exposures measured in the same way in the groups being compared? Was follow-up sufficiently long and complete? Is the temporal relationship correct? Is there a dose-response gradient? What are the results? How strong is the association between exposure and outcome? How precise is the estimate of the risk? Will the results help me in caring for my patients? Are the results applicable to my patients? What is the magnitude of the risk? Should I attempt to stop the exposure?


Background: Many disease treatment tools can be shifted into prevention. Many cardiac rehabilitation programs have focused on a 12-week exercise plan with minimal long-term follow-up. In 1995 Butterworth Hospital established a cardiac prevention and rehabilitation program focusing on long-term modification of cardiovascular risk factors. Clinical pathway: The pathway was created as the outpatient extension of three inpatient cardiovascular pathways. Unlike inpatient pathways, the outpatient pathway was integrated into the medical record as a major care planning and documentation tool. Enrollment: Since the entry of the first group of patients in January 1995, average quarterly enrollment has increased from less than 15% to 32% of eligible patients. The report cards: Butterworth adopted Dartmouth Medical Center’s (Hanover, NH) value compass and instrumental panel approach under the rubric of report card. As an internal, clinical quality improvement tool, the report card is not used for public reporting, although prevention and rehabilitation report cards are provided to payers. Information on cost and utilization, patient satisfaction, functional health status, and clinical outcomes, as well as the current improvement activities, are covered. Report cards have been issued in June 1996, Sept. 1996, and Jan. 1997, each highlighting activities that drive program improvements. Conclusion: The combination of case management, pathways, an outcomes database, and report cards creates a marketable program for secondary prevention of cardiac disease.


This is the fifth in a series of articles describing approaches to and topics for health needs assessment, and how the results can be used effectively.

The authors propose a method to generate information relevant to the decision tree that adds additional perspective to the characterization of health quality during survival. Their approach uses survival data to distinguish two attributes of utility: prolongation of life and quality of life (QOL). Health-state transition probabilities correspond to the prolongation of life and are modeled in a discrete-time transient semi-Markov process. Quality-of-life-state transition probabilities are derived from the assumptions of a simple recurrent Markov process. They reflect events within the health-state sojourn time that differentiate perceptions of pain and suffering over a short fixed time period. Outcomes for these two dimensions of utility are highly relevant to the assessment of medical technology that might prolong life at the cost of increased pain and suffering, implying a reduced QOL. The methods are demonstrated on a subset of follow-up data from the Beta-Blocker Heart Attack Trial (BHAT). (Abstract by: Author)


This article presents how to assess the economic impact of a hospital on a rural community. The economic impact is identified by assessing the direct, induced, and indirect impacts that result because of the presence of a hospital in a rural community. The methodology utilizes survey data and estimation procedures for four rural hospitals. The economic impact estimates are based on microdata. Income multipliers are estimated for each of the rural communities. The research demonstrates that rural hospitals do make significant economic contributions to the communities they serve. Community leaders can use the model presented to evaluate the economic impact of their local hospital.


Many hospital administrators recognize an increasing need to educate the public on the important role their institutions play in the economic viability of the local economy. Reasons include negative coverage by the press of increasing hospital costs, eroding philanthropy, managed care programs mandating out-of-area preferred providers, and the declining city revenues, which have caused some municipalities to attempt to place not-for-profit health care facilities on the tax roles. This article reviews a technique that can be used by hospitals to build community support by demonstrating the favorable economic impact hospitals have on the communities they serve.


The pressure to improve health care and provide better care at a lower cost has generated the need for efficient capture of clinical data. Many data sets are now being defined to analyze health care. Historically, review and research organizations have simply determined what data they wanted to collect, developed forms, and then gathered the information through chart review without regard to what is already available institutionally in computerized databases. Today, much electronic patient information is available in operational data systems (for example, laboratory systems, pharmacy systems, and surgical scheduling systems) and is accessible by agencies and organizations through standards for messages, codes, and encrypted electronic mail. Such agencies and organizations should define the elements of their data sets in terms of standardized operational data, and data producers should fully adopt these code and message standards. The Health Plan Employer Data and Information Set and the Council of State and Territorial Epidemiologists in collaboration with the Centers for Disease
Control and Prevention and the Association of State and Territorial Public Health Laboratory Directors provide examples of how this can be done. (Abstract by: Author)


Generic health surveys have been proposed for use in increasingly diverse applications and populations. This paper describes the history of generic tools in the past 30 years and suggests a more modern measurement platform for advances in the 21st century. Many generic tools lack the precision required for effective health care decision making. A meaningful goal for the next era of development of generic measures should be the generation of equiprecise measurement for generic health concepts. Equiprecise tests yield measures of equal precision at all levels of the underlying construct. Equiprecise measurement can be achieved through conjoint use of computerized-adaptive testing as the survey platform and item response theory as the measurement theory. (Abstract by: Author)


Since the collapse of federal health system reform legislation in 1994, there has been a growing concern with the quality of care provided within managed care systems. Just as physicians practicing under a traditional fee-for-service payment base have financial incentives to do as much as possible for each patient (doing well by doing good), physicians working for managed care plans are sometimes given perverse incentives to do as little as possible. A major quality-related concern among patients and payers (often referred to jointly and ambiguously as consumers of care) is the much larger role assigned to primary care physicians in managed care plans than is usually the case with traditional indemnity insurance.


In economic evaluations of health treatments, the sensitivity of a cost-benefit (CB), cost-effectiveness (CE) or cost-utility (CU) analysis to changes in modeling assumptions, variation in data, and sampling error is important. The typical approach to this problem is ad hoc experimentation; namely, a few parameters of particular interest are changed, either separately or in combination, over plausible ranges. The impact of random variation in the data is seldom explored beyond parametric tests of the statistical significance of estimated coefficients. This note suggests a systematic approach to sensitivity analysis. Bootstrap sampling is used to determine to what extent the patients' response to treatment and economic consequences might vary due to many replications of a clinical trial. (Abstract by: Author)


That a treatment selected for a given condition works, or that it works better than alternative treatments, or that it was selected because it works as well as but is cheaper than alternative treatments, should be of pivotal concern to clinicians and is of central concern to patients and to health care managers. Attempts to address these concerns have resulted in what is now widely termed the 'effectiveness movement'. The protagonists of the movement have been concerned to create a culture of evaluation and inquiry within which the formulation of evidence-based clinical guidelines and their introduction into routine practice have played a prominent part. The need to ensure cost effectiveness of clinical intervention has been at least as emphasized as the need to ensure the clinical effectiveness of health care interventions. Although cost-effectiveness analyses are now an indispensable feature of practice guideline
formulation and treatment evaluation, few studies have examined any deterioration in patient outcome associated with successful cost containment. An adequate understanding of the concept of clinical effectiveness and the associated aims of the 'effectiveness movement' is central to an understanding of the future nature and extent of health service provision, not simply in the UK but also internationally. Having examined the concepts of efficiency and appropriateness previously (O'Neill, Miles & Polychronis 1996, Journal of Evaluation in Clinical Practice 2, 13-27) we move in this second of two articles to a detailed explanation of the concept of effectiveness, and to an examination of the derivation and use of clinical practice guideline, concluding with a consideration of the role of practice guidelines in ensuring the cost effectiveness of health care intervention. The reservation is expressed that a ‘guidelines culture’, when established, will be manipulated by health care commissioners for largely political purposes, creating a systematic bias in the purchasing process that will actively disadvantage a range of patient groups. (Abstract by: Author)


What common sense decision strategies do patients with cancer use when they are making health care choices that include alternate therapies? Existing research indicates that oncology patients are making alternate choices while associated with biomedicine. Often patients’ decision strategies are exploited by the alternate system to promote and market alternate products. Although some of these practices are benign, others are dangerous or may interfere or delay successful treatment in biomedicine. Therefore, it seems important for biomedical professionals to understand patients’ common sense decision patterns. A decision tree model, outlining patients’ decision strategies, has recently been developed through intensive interviews with 300 patients who were diagnosed with cancer of the respiratory and digestive systems. The two-phase methodology included, first, a context sensitive approach to develop the model, followed by a predictive approach testing the model developed in the first phase on a separate yet similar random sample of patients. The discussion in this article focuses on the research, the patterns of the decision tree model, and the implications and adaptability of this model to nursing practice. (Abstract by: Author)


Rural hospital consortia are relatively new organizations that have been developed to help improve the viability of participating hospitals. This paper describes the characteristics of rural hospital consortia in the United States and develops and tests a measurement model of their underlying structure. The measurement model, which characterized consortia structure in terms of degree of member commitment, degree of complexity, scale of operations, and degree of formalization, provided a good fit to the sample data. Most consortia appear to have followed a relatively conservative course that involved the development of programs that had limited sensitivity and financial risk for individual hospitals. This suggests that rural hospital consortia may not become a model for major structural change in the rural health care system. Future research should examine the evolution of rural hospital consortia from an organizational life cycle perspective. (Abstract by: Author)


The article addresses the following issues: Are the outcome measures accurate and comprehensive? Were there clearly identified, sensible comparison groups? Were the comparison groups similar with respect to important determinants of outcomes, other than the one of interest? Factors that may systematically affect outcomes: The WHO, WHAT, WHEN,
and WHERE of the provision of services. Determination of the sources of variation in outcomes (whether it derived from differences in prognosis or in treatment)


The article addresses the following issues: aAre the criteria valid? Was an explicit and sensible process used to identify, select, and combine evidence for the criteria? What is the quality of the evidence used in framing the criteria? If necessary, was an explicit, systematic, and reliable process used to tap expert opinion? Was an explicit and sensible process used to consider the relative values of different outcomes? If the quality of the evidence used in originally framing the criteria was weak, have the criteria themselves been correlated with patient outcomes? Were the criteria applied appropriately? Was the process of applying the criteria reliable, unbiased, and likely to yield robust conclusions? What is the impact of uncertainty associated with evidence and values on the criteria-based ratings of process of care? Can you use the criteria in your own practice setting? Are the criteria relevant to your practice setting? Have the criteria been field-tested for feasibility of use in diverse settings, including settings similar to yours?


The article addresses the following issues: What were the results? What were the incremental costs and outcomes of each strategy? Do incremental costs and outcomes differ between subgroups? How much does allowance for uncertainty change the results? Will the results help in caring for my patients? Are the treatment benefits worth the harms and costs? Could my patients expect similar health outcomes? Could I expect similar costs?


The article addresses the following issues: Are the results of the study valid? Primary guides: Did the overview address a focused clinical question? Were the criteria used to select articles for inclusion appropriate? Secondary guides: Is it unlikely that important, relevant studies were missed? Was the validity of the included studies appraised? Were assessments of studies reproducible? Were the results similar from study to study? What are the results? What are the overall results of the review? How precise were the results? Will the results help me in caring for my patients? Can the results be applied to my patient care? Were all clinically important outcomes considered? Are the benefits worth the harms and costs?


One strategy for dealing with the burgeoning medical literature is to rely on reviews of the literature. Although this strategy is efficient, readers may be misled if the review does not meet scientific standards. Therefore, guidelines that will help readers assess the scientific quality of the review are proposed. The guidelines focus on the definition of the question, the comprehensiveness of the search strategy, the methods of choosing and assessing the primary studies, and the methods of combining the results and reaching appropriate conclusions. Application of the guidelines will allow clinicians to spend their valuable reading time on high-quality material and to judge the validity of an author’s conclusions.

This is the first in a series of articles created to guide readers of medical literature through the process of gleaning information that is relevant and applicable to their medical disciplines and clinical practices. This article offers an overview of the literature databases (like MEDLINE) one can reference to compile a collection of articles, and it gives tips on how to decide if an article is likely to provide valid and relevant results.


They provide a few examples of some advances in the methods and the application of decision analysis.


This paper discusses the major approaches to rationing care in each category, and provides, where possible, evidence on the effects of employing such instruments. (Abstract by: Author)


BACKGROUND: Locum tenens, the use of a substitute physician to replace a physician who must be temporarily absent from his practice, is widely accepted in the United States. Locum tenens has not previously been described or studied in pediatric practice. OBJECTIVE: This article describes a locum tenens service for Colorado and Wyoming pediatricians provided by the Division of General Pediatrics and Pediatric Emergency Medicine at the University of Colorado School of Medicine and the Children's Hospital of Denver. An analysis and an evaluation of the program are presented, and implications are discussed. METHODS: All program data were prospectively collected and tabulated and later analyzed for the period from July 1, 1994, through June 30, 1995. A survey of all physicians using the Pediatric Locum Tenens Service was conducted within 2 months of service to evaluate the program and to refine the orientation, credentialing, and evaluation processes. RESULTS: During the year, 35 pediatricians (14% of pediatricians in Colorado and Wyoming) made 97 requests for 398 days of locum tenens coverage. Coverage was used for vacation (85%), medical education (10%), medical leave (3%), and family matters (2%). Solo and rural pediatricians used the service at a higher rate than pediatricians in group or urban practices. Eighty-six percent had never used locum tenens coverage before because of either the expense (67%) or their unwillingness to trust their practices to physicians or services with whom or with which they were unfamiliar (50%). The majority (83%) were willing to pay an amount for locum tenens equal to the net income derived from the locum tenens coverage in the practice. None indicated a willingness to pay more than that. Referrals and admissions to the Children's Hospital from the pediatricians who used the service increased by 22% during the study period compared with the preceding year, whereas referrals and admissions increased by 9% among all other Colorado and Wyoming pediatricians. All pediatricians completed surveys, and satisfaction with the locum tenens pediatricians, charges, and program administration was high. Their suggestions are described. DISCUSSION: The following topics are discussed: (1) the economics of pediatric locum tenens; (2) the use of a locum tenens service as a physician relations program by children’s hospitals or academic departments of pediatrics; (3) guidelines for orientation of locum tenens pediatricians; and (4) a proposed evaluation and credentialing process for locum tenens physicians. (Abstract by: Author)

The article addresses the following issues: Are the results of the Study Valid? Were all important strategies and outcomes included? Was an explicit and sensible process used to identify, select, and combine the evidence into probabilities? Were the utilities obtained in an explicit and sensible way from the credible sources? Was the potential impact of any uncertainty in the evidence determined?


The article addresses the following questions: What are the results? In the baseline analysis, does one strategy result in a clinically important gain for patients? If not, is the result a toss-up? How strong is the evidence used in the analysis? Could the uncertainty in the evidence change the result? Will the results help me in caring for my patients? Do the probability estimates fit my patients’ clinical features? Do the utilities reflect how my patients would value the outcomes of the decision?


In this article, (based on information from the two previous articles with similar titles), the authors present how to interpret the results and generalizability of a clinical decision analysis.


This article presents an approach to differential diagnosis in the clinical setting using studies of disease probability.


As managed care and integrated health care delivery systems have developed, the credentialing of physicians, historically a function of the medical profession, has moved to other organizations and individuals. The criteria for credentialing and appointment to hospital staffs and care provider panels has been expanded to include economics and care providers’ use of hospital or health organization resources. The rights, responsibilities, and liabilities of those in this enhanced credentialing process are now being played out (Abstract by: Author)


The need to evaluate the effects of health technologies in clinical practice is increasingly important. In this article, we review the advantages and limitations of naturalistic randomized clinical trials (RCTs) and database analyses, the two primary methods for evaluating treatment effectiveness. Also, we comment on a newer research strategy, cross-design synthesis, which proposes the complementary use of both experimental RCTs and observational database methodologies to avoid the main weaknesses of each: respectively, the lack of external and internal validity. Finally, we propose a new strategy--randomized database studies--capable of generating results with an acceptable balance between internal and external validity. This
strategy consists of the simultaneous use of both experimental and observational tools in the assessment of drugs' effectiveness. Randomization is essential to minimize comparison bias, and one possibility for such studies is that randomization modules could be included in computer-based patient records. Although we identify some of the difficulties in implementing the process, the progressive standardization of clinical practice and the development and widespread adoption of improved computer-based patient records could facilitate the use of randomized database studies as a new method of research.


BACKGROUND: Innovation in primary care in the UK, in terms of new service developments, is occurring at a fast pace. However, little information is available on the costs and benefits of these changes. OBJECTIVES: We aimed to illustrate the use of programme budgeting and marginal analysis (PBMA) as a framework for evaluating innovation in primary care, using an example of practice-based diabetes care. The aim was to examine changes in the use of practice resources and the changes in benefits to patients, following the introduction of a diabetes clinic. METHODS: PBMA is a form of pragmatic economic evaluation combining practice data for the 'before' period and data from the literature to model the 'after' period. RESULTS: In 1995/6, the total amount of resources devoted to diabetes care in the two practices was 145813 pound sterling (634 pound sterling per patient). Of this sum, 62% was allocated to outpatient visits, 28% to prescribing, 5% to hospital admissions, 2% to GP consultations and 2% to tests. The literature suggests that a nurse-run diabetes clinic would result in similar health outcomes and better access for patients. The introduction of such a clinic could potentially save each practice between 2000 pound sterling and 16000 pound sterling per year. This result takes into account a wide range of assumptions about changes in resource use, but does depend on the findings of previous studies. CONCLUSIONS: The results of this study show that PBMA is a useful framework for helping practices be accountable and make 'evidence-based' decisions about service innovations in primary care. (Abstract by: Author)


Access to health care has diminished for rural Americans due in part to a record number of rural hospital closures. Hospitals have served as the infrastructure of rural health care. When hospitals close, other health services and providers are frequently lost. Adequate access to health care is one determinant of health. An ecological perspective on environment reveals multiple levels of influence that support or do not support access to rural health care. Implications for nursing science and practice involving all levels of environment are suggested by an ecological view.


Cancer doctors and nurses are clustered in the metropolitan areas of Virginia. However, cancer patients are found throughout the state, and cancer mortality time trends are worse in the rural areas. Efforts to recruit cancer physicians and nurses to rural hospitals have been unsuccessful due to the practice characteristics, educational isolation, and economic disincentives. Our rural cancer education program involves the physicians and nurses currently in practice at two rural hospitals. We provide hands-on training in cancer care, continuing education, and intense week-long educational sessions. We have observed changes in physician and nurse practice styles that benefit the cancer patient including effective pain management, enrollment of patients on clinical trials, increased use of adjuvant therapy, and
breast conservation. We are providing state-of-the-art cancer care at the rural hospitals in the Cancer Outreach Program. We have improved the educational opportunities and increased utilization of the resources of the academic career center. We can modify the practice characteristics by providing needed clinical programs and enhancing the rural hospital/academic medical center link. We have shown that rural cancer care can be revenue-neutral or positive, and we are seeking creative solutions to the financial disincentives of rural specialty practice. We can assist the rural hospital in the recruitment of oncology specialty nurses and physicians by providing cancer care services, and the patient caseload is available to teach prospective rural subspecialty practitioners at the rural hospitals. (Abstract by: Author)


The demand-control model (DC model) in occupational epidemiology suggests that health, an individual attribute, is partly determined by work organization, via the interplay of demand and control, job strain. The objective of this study was empirical assessment of the model's tenet of an organizational determination of individual health. An emerging analytic method, multi-level modeling, permits such an assessment. The study encompasses two large Swedish human service organizations. It was based on a nationally representative sample of 291 local organizational units (level 2) with 8296 employees (level 1), a median of 18 employees per unit. 5730 persons (69.1%) completed the questionnaire. Listwise deletion of missing data left a net study base of 4756 individuals in 284 units. Missing data were largely random. Demand and control were measured by standard questions and combined into a job strain index. Two such indices were calculated, one for quantitative demands and one for emotional demands. Individual attributes included age, gender, marital status, having children, social anchorage, and education. There were two dependent variables, self-assessed psychovegetative symptoms (worry, anxiousness, sadness, sleep difficulties, restlessness, and tension) and exhaustion (fatigue, feelings of being used up and overworked), both measured as summative indices. For psychovegetative health, a null model yielded 2.2% level 2 variance, unchanging when individual attributes were included in a random intercepts model. Inclusion of the strain variables rendered level 2 variance non-significant, decreasing level 1 variance by 23% and level 2 variance by 62%. For exhaustion, level 2 variation was 8.3% in the null model and 1.6% in the final model, with strain variables. The strain variables utilized in the DC-model thus draw a substantial part of their variation from the organizational level. It is concluded that the claim of the DC model to rely on organizational factors receives support. (Abstract by: Author)


Performance measurement has become increasingly popular in the health care delivery system of the United States. Until recently, the hospital was the most commonly scrutinized setting. With the expansion of managed care and the resulting compilation of large administrative databases, interest in performance measurement beyond the hospital setting has increased considerably. In particular, the performance of health maintenance organizations is now being assessed and reported publicly. The performance of individual physicians is also garnering considerable attention. This paper summarizes some of the many developments in performance measurement in managed care. The Health Plan Employer Data and Information Set (HEDIS) is described in the context of the national Report Card Pilot Project and with respect to local report card projects emerging around the United States. The lessons learned are identified, particularly with respect to external auditing of HEDIS data. Finally, the new initiatives of physician profiling and outcomes reporting are discussed. (Abstract by: Author)

Previous discussions of methods for the efficient allocation of health care resources subject to a budget constraint have relied on unnecessarily restrictive assumptions. This paper makes use of established optimization techniques to demonstrate that a general mathematical programming framework can accommodate much more complex information regarding returns to scale, partial and complete indivisibility and program interdependence. Methods are also presented for incorporating ethical constraints into the resource allocation process, including explicit identification of the cost of equity. (Abstract by: Author)


This is the twelfth in a series of articles dealing with issues arising as clinical practitioners increasingly take on managerial roles.


This article reviews the early experience of organizations in the US who have attempted to design, develop and implement disease management programmes. A system approach is recommended and outlined as a solution to the obstacles that have hindered success of "first generation" disease management programmes. The authors focus on important considerations and specific components needed to build a solid foundation for the successful implementation of disease management systems.


Decision analysis offers powerful techniques to understand and evaluate uncertain clinical situations better. Decision analytic models are appearing with increasing frequency in health policy planning, clinical information and decision-support computer systems, evaluations of clinical pathways, development of clinical practice or utilization review guidelines, and epidemiologic research. This article describes the structure, application, and limitations of the more popular decision analytic methods, including decision trees, Markov models, Monte Carlo simulation, survival and hazard functions, fuzzy logic, and sensitivity analysis. Understanding the nature of these methods will help readers to assess better the appropriateness of their use in published reports. (Abstract by: Author)


To obtain cost data needed to improve managed care decisions and negotiate profitable capitation contracts, most healthcare provider organizations use one of three costing methods: the ratio-of-costs-to-charges method, the relative value unit method, or the activity-based costing method. Although the ratio-of-costs to charges is used by a majority of provider organizations, a case study that applied these three methods in a renal dialysis clinic found that the activity-based costing method provided the most accurate cost data. By using this costing method, healthcare financial managers can obtain the data needed to make optimal decisions regarding resource allocation and cost containment, thus assuring the long-term financial viability of their organizations. (Abstract by: Author)

As rising cost impact managed care, a successful manufacturing costing method is being applied to help managers make decisions on capitation contract bidding, cost containment, and organizational structure. In the healthcare environment of the 1990s, accurate costing has become much more important. Activity-based costing (ABC) reflects one of the most significant advances in cost accounting and is now being used in numerous health organizations including about 20% of US and Canadian hospitals. The results of applying ABC to two alternative treatments in an independent, nonprofit, full-service renal dialysis clinic are presented.


This paper develops a mathematical framework for identifying optimal transfer times from a low-intensity, watchful waiting therapy to direct intervention. It allows for the probability that patients discharged from watchful waiting will suffer disease recurrence. Two specific functional forms for the resolution of the relevant medical condition are modeled (modified exponential and logistic). Initially structured as an expected cost minimisation problem, the analysis is extended to include the possibilities of differential benefits of the therapies and discounted cost and benefit valuations. The framework demonstrates the existence of non-synchronous transfer optima. (Abstract by: Author)


The article addresses the following issues: What are the recommendations? Are practical, clinically important recommendations made? How strong are the recommendations? What is the impact of uncertainty associated with the evidence and values used in the guidelines? Will the recommendations help you in caring for your patients? Is the primary objective of the guideline consistent with your objectives? Are the recommendations applicable to your patients?


The transition from traditional health care delivery to managed care needn’t cause alarm to speech-language pathologists and audiologists—so long as they learn the new rules of the game. This article provides these “rules” as they apply to the utilization of actuary data.


A checklist format is used to provide a framework for rural hospital executives and community members for gauging the health and stability of rural hospitals and rural hospital systems. Benchmarks are provided for financial and operational performance and emphasis is placed on medical staff size and physician recruitment. Physician/hospital organizations and regional partnerships are used as examples of strategies available to rural providers. The importance of market knowledge and regional strategic alliances also is stressed. In an era of dwindling resources and tight reimbursement, rural providers are encouraged to consider cooperative clinical programming and technology consolidation. (Abstract by: Author)

Although it is well known that clinical trial findings and actual clinical experience can differ substantially in pharmaceutical decision making, it is our working hypothesis that this divergence is critically important in the area of psychopharmacology. We support this contention with a discussion of recent findings from post-marketing pharmacoepidemiologic and pharmacoeconomic investigations of clozapine. The pharmacoeconomic evaluations purport to show cost savings of clozapine versus standard neuroleptic therapy but these conclusions are flawed, in large part because the epidemiologic investigations on which they are based are inadequate. To correct this situation, long-term, randomized field trials (usual practice settings) are needed to compare costs and outcomes of clozapine versus standard therapy. The design of these studies should incorporate multidimensional outcomes, including social function, employment, and rehospitalization, as well as measures of symptoms and self-reported quality of life. Pharmacoeconomic evaluations that adopt the designs of typical clinical trials with limited outcome measures, such as symptoms or self-reported quality of life measures, will not be sufficient to determine cost-effectiveness for psychopharmacologic therapies of severe mental disorders. (Abstract by: Author)


Practice guidelines have become an integral part of clinical practice. There are inherent potential problems involving their source, methodology, and measurement of their impact. Physicians may understandably have reservations about embracing practice guidelines. Such guidelines, however, offer the opportunity to ensure continued quality while controlling cost and resource utilization. (Abstract by: Author)

Outcome and Quality Measurement


See General Methodology.


See Methodological Tools—Economic Evaluation.


See Methodological Tools—Economic Evaluation.


Healthcare reform is a topic consuming the time and energy of many healthcare professionals, administrators, and politicians. One goal of reform is to improve value--better quality health care for less cost. Unfortunately, much of the current debate proceeds without clear definitions of quality or cost. To have profitable discussion, we must have precise definitions. With these definitions in hand, the technique of decision analysis provides a unique opportunity to evaluate quality and costs of healthcare decisions simultaneously. We believe it
is imperative for physicians to become familiar with this important and powerful tool. (Abstract by: Author)


Quality management has become issue No. 1 in organizations throughout the country. Hospitals have joined this crusade and are embarking on their own programs to maintain their competitive edge. TQM or CQI has been identified as showing great success in achieving quality. As TQM systems begin developing in hospitals, CCUs will be called on to join in these efforts. By understanding what TQM is, how it is used, and how it can be applied, CCU staffs will be able to incorporate TQM in their own practices. By choosing projects carefully, using scientific measurement in clinical and nonclinical areas, and developing a team-based approach, the CCU staff can achieve improved clinical outcomes as well as improved procedures that result in better staff and patient satisfaction.


Outcomes research is a rapidly evolving field that incorporates epidemiology, health services research, health economics, and psychometrics. Measurement of clinical and other outcomes has become increasingly important to the stakeholders in a rapidly changing health care environment. The desire to improve outcomes and control costs has stimulated greater interest in cost-effectiveness studies, which determine how well effective therapies work in the usual practice setting and how much they cost. The application of outcomes principles to the practices of health care providers has resulted in efforts to implement disease management programs. Unlike traditional programs carried out by physicians, these new efforts are based on systematic population-based approaches to identifying persons at risk, intervening with specific programs of care, and measuring clinical and other outcomes. The new efforts depend heavily on modern information systems. (Abstract by: Author)


Administrative data result from administering health care delivery, enrolling members into health insurance plans, and reimbursing for services. The primary producers of administrative data are the federal government, state governments, and private health care insurers. Although the clinical content of administrative data includes only the demographic characteristics and diagnoses of patients and codes for procedures, these data are often used to evaluate the quality of health care. Administrative data are readily available, are inexpensive to acquire, are computer readable, and typically encompass large populations. They have identified startling practice variations across small geographic areas and supported research about outcomes of care. Many hospital report cards (which compare patient mortality rates) and physician profiles (which compare resource consumption) are derived from administrative data. However, gaps in clinical information and the billing context compromise the ability to derive valid quality appraisals from administrative data. With some exceptions, administrative data allow limited insight into the quality of processes of care, errors of omission or commission, and the appropriateness of care. In addition, questions about the accuracy and completeness of administrative data abound. Current administrative data are probably most useful as screening tools that highlight areas in which quality should be investigated in greater depth. The growing availability of electronic clinical information will change the nature of administrative data in the future, enhancing opportunities for quality measurement. (Abstract by: Author)

In this note the veil of ignorance approach is tested as a basis for empirically determining the shape of the social welfare function for QALYs. An experiment is carried out where the participants choose between different societies that differ with respect to per capita QALYs and the distribution of QALYs. The answers are analyzed using logistic regression analysis. According to the results the respondents are willing to give up 1 QALY in the group with more QALYs to gain 0.45 QALYs in the group with fewer QALYs, but this trade-off is independent of the size of the difference in QALYs between the groups. (Abstract by: Author)


The theoretical model of QALYs is based on risk neutrality with respect to life years or constant proportional risk posture with respect to life years. It is shown that discounting of QALYs is inconsistent with these assumptions. For discounting to be consistent with individual preferences in a QALY model, individuals have to be risk-neutral with respect to discounted life years or exhibit constant proportional risk posture with respect to discounted life years. For the time-tradeoff method to be consistent with these assumptions, the QALY weights have to be derived by dividing the number of discounted life years in full health by the number of discounted life years in the assessed health states. (Abstract by: Author)


To increase the utility of administrative databases, it has been recommended that they include disease-specific, patient-centered outcome measures. This paper reviews practical and theoretical considerations and the critical evidence to support this recommendation. The strengths and weaknesses of the recommended approach are illustrated by examples of disease-specific measures for arthritis and musculoskeletal diseases. Current experience suggests that routine capture of these measures in administrative databases has formidable practical problems and would be unlikely to affect patient care. They could be used as gross indicators of a population’s experience but would be insensitive to clinically meaningful improvement on the level of the individual patient. By themselves, these measures are unlikely to identify actionable strategies to improve outcomes, but they could improve efficiency. Overall, implementing this type of disease management improvement strategy would have little value in direct patient care and would be costly. (Abstract by: Author)


Critical care units have proliferated over the past three decades and the cost of care in these units has increased dramatically during that period. These units have flourished despite a surprising lack of adequate data to support their overall efficacy, and indeed a number of studies suggest that many patients admitted to these units are either too ill or too healthy to benefit. Dr Luce reviews recent changes in the organization and delivery of critical care and argues that the utilization and quality of critical care units can be improved through a combination of strategies. He advocates two strategies to decrease the demand for, or increase the supply of, critical care beds: more efficient use of intermediate care units and the development of clear institutional guidelines regarding the termination of treatment. In addition, although nominally eschewing the use of “formal” rationing policies, he advocates the development of admission and discharge policies to guide physicians during periods of low bed availability. Finally, he advocates greater leadership roles for professional critical care unit
directors. This final suggestion has great merit but, as Dr Luce recognizes, a heightened role for critical care unit directors raises ethical and legal issues about the autonomy of both patients and physicians that need to be explored thoroughly.


Evidence-based medicine provides practical tools for assessing and improving the quality of health care. This article provides an overview of the application of evidence-based medicine concepts to the measurement of quality of care in obstetrics and gynecology is also reviewed. Last, the principle of evidence-based management of obstetrics and gynecologic services is described.


To achieve more cost-effective and equitable use of health resources, improved methods for defining disease burdens and for guiding resource allocations are needed by health care decision makers. Three approaches are discussed that use indicators that combine losses due to disability with losses due to premature mortality as a measure of disease burden. These indicators can also serve as outcome measures for health status in economic analyses. However, their use as tools for measuring and valuing human life raises important questions concerning the measurement of mortality and the multi-dimensions of morbidity; valuing of life, particularly regarding weighting productivity, dependency, age, and time-preference factors; and conflicts between equity and efficiency that arise in allocation decisions. Further refinement of these tools is needed to (1) incorporate national and local values into weighting; (2) elaborate methods for disaggregating calculations to assess local disease patterns and intervention packages; and (3) develop guidelines for estimating marginal effects and costs of interventions. Of utmost importance are methods that ensure equity while achieving reasonable efficiency.


Several valuation techniques are in use for quality adjusting life years in cost utility analysis. The paper gives an overview of the variability in results. A close inspection of a number of instruments with respect to their theme, instructions, decision framing and the phrasing of questions make many of the observed differences in results understandable. When judging the validity of the different techniques, three points should be kept in mind. One is that statements about validity should be made with respect to concrete versions rather than broad categories like 'the rating scale,' 'time trade-off' etc. Another point is that a valuation technique that is valid in clinical decision analysis may not be valid in health program evaluation, and vice versa. The third point is that quality weights for life years are empirically more meaningful, in the sense that they are more amenable to empirical testing, if they are interpreted simply as preference weights rather than measures of amounts of well life in the utilitarian tradition. Time trade-off with a moderate time horizon is recommended in clinical decision analysis, while a combination of time trade-off and a variant of person trade-off is recommended in health program evaluation.


The person trade-off technique is a way of estimating the social value of different health care interventions. Basically it consists in asking people how many outcomes of one kind they consider equivalent in social value to X outcomes of another kind. The paper outlines a number
of the author's previous studies using the technique. The studies suggest that while the technique is theoretically appealing for resource allocation purposes, it is in practice quite demanding. It needs to be applied in fairly large groups of subjects to keep random measurement error at an acceptable level. Possible framing effects include the effects of argument presentation and the choice of start points in numerical exercises. To control for these effects, it seems important to take subjects through a multistep procedure, in which they are induced to carefully consider the various arguments that might be relevant in each exercise and to reconsider initial responses in the light of their implications. The investigator must also think through which decision context he/she wishes to study and make his/her choice of context very clear when reporting the results. (Abstract by: Author)


A major health care policy issue in this era of accountability is controlling the introduction and utilization of increasingly sophisticated and expensive health care technologies. Data are needed about both the effectiveness and the costs of assistive technologies before making decisions without relying on "that's what we did last time," "gut feelings," or even "educated guesses." Services, such as assistive technology, fall in the category where rigorous scientific evidence about cost-effectiveness is virtually nonexistent. The field of medical technology assessment has been studying cost-effectiveness for decades and offers many methodological ideas to related fields such as assistive technology. Based on the experiences of medical technology assessment, the measurement of health state preferences and its use to estimate quality-adjusted life years is discussed in this paper. Economic evaluation can be defined as the comparative analysis of alternative courses of action in terms of both costs and consequences. Information from economic evaluation studies, including the use of quality-adjusted life years as an outcome measure, helps us to determine which health care services we can afford to incorporate into routine clinical practice. The major forms of economic evaluation for health care described in this paper are cost-benefit, cost-effectiveness, and a special form of cost-effectiveness, cost-utility. Important national and state health care policies are being considered and implemented on the basis of economic evaluation data and these are bound to have major implications for assistive technology. The assistive technology field needs to be aware of these methods both to understand how large scale health-related policy decisions are impacted by economic evaluations and to become participants in and contributors to this process. (Abstract by: Author)


Increasingly, health care practitioners are addressing economic (health care resource utilization) and nonclinical (patient satisfaction and quality of life) outcomes along with traditional clinical outcomes (morbidities, mortalities, cure rates, etc.) in assessing the impact and quality of care provided to their patients. These additional outcomes also are collected to assist health care providers to meet accreditation standards and to aid in the selection of alternative health care interventions in an environment of limited resources. This article reviews the advantages and disadvantages of assessing both clinical and nonclinical outcomes. A review of key questions that health economic and outcome studies should answer is provided. In addition, relevant resource utilization and outcome measures are identified based on a variety of provider/payer perspectives. Finally, a framework to develop a strategic operating plan for measuring and valuing outcome measures in an ambulatory setting is presented. (Abstract by: Author)

As CCM has grown, the diversity of ICU patients, as well as that of ICU organization and structure, has grown. This growth has led to numerous questions regarding health care delivery in the ICU. These questions contributed to the development of systems that objectively evaluate the quality of health care delivery in ICUs. Severity of disease scoring systems have been developed and allow for a valid analysis of ICU performance at several levels. These systems should help intensivists determine how health care delivery can be optimized in ICUs. Despite the controversy that surrounds severity of disease scoring and prognostic systems, it is not unreasonable to suggest that, because of the feedback these systems would provide, health care delivery in the ICU would be improved through more extensive use of them at the present time. The information acquired through the use of objective scoring systems ultimately must be used to improve the efficiency of ICUs. The structure and organization of ICUs in the United States, as well as the training of those who treat ICU patients, are excessively diverse, and a more standardized approach to health care delivery in the ICU ultimately will be required. Present information suggests that decentralized ICUs with part-time ICU physicians result in poorer outcomes. The APACHE III study intends to explore these relationships in more detail. Certainly, more studies looking at these issues are needed, but we are at least beginning to answer the questions that resulted from the rapid growth of critical care in the 1980s. The SCCM data suggest two possible alternatives, not necessarily exclusive of each other: (1) A large percentage of ICUs may be obligated to undergo structural changes in the near future. (2) Regionalization of critical care, already present, may continue. Certain rural areas may find it more expedient to send the most critically ill patients to tertiary centers in nearby cities, as opposed to a wholesale upgrading of the delivery of care in their own ICUs. Ultimately, all hospitals will be obligated to provide patients access to the highest quality of critical care.


See Methodological Tools—Economic Evaluation


See Methodological Tools—Economic Evaluation


The growing emphasis on cost-effectiveness in the United States health care industry has highlighted the need for comprehensive outcomes research in a variety of medical specialties. Currently, there is a relative paucity of reliable data characterizing the long-term results of many medical and surgical treatments. This shortage of outcomes research is particularly acute within plastic surgery where the benefits of treatment are often intangible and notoriously difficult to measure. In evaluating the effectiveness of medical treatment, conventional clinical research has focused primarily on morbidity and mortality as the outcomes of interest. In contrast, current outcome studies assess the results of interventions from the patient's perspective, measuring the impact of medical care on physical functioning, well being, and quality of life. The resulting data can assist consumers, providers, and payers in making more appropriate health care decisions. As the outcomes movement has matured, it has evolved into two major areas of study: effectiveness research that evaluates the relationships between specific medical interventions and outcomes of care, and quality assessment that seeks to provide the best outcomes at the most reasonable costs. This review details the origins and trends of current outcomes research, examining the implications of this movement.
for plastic surgery. The growing impact of outcomes data on treatment guideline formulation in both the public and private sectors is also described. Finally, a brief review of outcomes study design, including definition of variables and selection of instruments, is presented. (Abstract by: Author)

Applications Of Methodology

Cardiology


Several previous studies of hospital utilization by nonelderly rural residents suggest that local rural hospitals have been increasingly bypassed, often for care in urban hospitals. This resulted in lost volume for rural hospitals, detracting from their financial viability. It is not clear to what extent elderly rural residents also bypass local hospitals and whether this reflects regionalization of treatment for some conditions or avoidance of local hospitals assumed to provide inadequate care. This study examines hospital use by aged rural Delaware Medicare beneficiaries living in a ZIP code area that has a local hospital during Fiscal Year (FY) 1987 (N = 670). Most of these Medicare beneficiaries were hospitalized locally. Those beneficiaries who bypassed local rural hospitals usually did so because cardiovascular surgical procedures were required and were often only performed in large urban teaching hospitals. Beneficiaries using nonlocal hospitals were similar to users of local hospitals with respect to age and sex and traveled an average of nearly 42 miles for treatment. "Bypassing" here appears to be due primarily to regional specialization of care rather than abandonment of local rural hospitals by rural residents. (Abstract by: Author)


Atherosclerotic heart disease is the principal cause of death in the United States and other industrial societies. Three major risk factors for developing coronary artery disease (hypertension, hypercholesterolemia, and smoking) are frequently seen in family practice patients. It is therefore important for family physicians to be able to assess an individual patient’s overall heart disease risk and provide advice and counseling to reduce that risk. This article describes a teaching-consultation clinic in which family practice residents learn to assess cardiac risk in patients and develop counseling skills to manage that risk. The role of the family physician in relation to the cardiologist is also discussed. (Abstract by: Author)


OBJECTIVE: To compare the relative risks and benefits of several clinical strategies for managing patients with chronic atrial fibrillation. DESIGN: Five recent randomized controlled trials of warfarin in atrial fibrillation, 6 randomized controlled trials of quinidine, and 13 longitudinal studies of low-dose amiodarone were used. A MEDLINE search was also done (1966 to present). MEASUREMENTS: A Markov decision analysis model was used to assess outcomes in large, hypothetical cohorts of patients with atrial fibrillation followed from 65 to 70 years of age within four clinical strategies: 1) no treatment; 2) warfarin; 3) electrical cardioversion followed by quinidine to maintain normal sinus rhythm; and 4) electrical cardioversion followed by low-dose amiodarone. RESULTS: IN this hypothetical cohort, fewer patients had disabling events with amiodarone (1.4%) than with quinidine (1.8%), warfarin
Amiodarone appeared to be associated with the lowest 5-year mortality (13.6%) when compared with warfarin (14.4%), quinidine (15.2%), and no treatment (18.2%). In terms of quality-adjusted life-years, amiodarone had the highest expected value (4.75 years), followed by warfarin (4.72 years), quinidine (4.68 years), and no treatment (4.55 years). Amiodarone remained the preferred strategy using the most plausible scenarios of risks associated with atrial fibrillation. Choices among warfarin, quinidine, and no treatment depended on estimates of bleeding rates with warfarin, stroke rates after discontinuing warfarin, quinidine-related mortality, and the quality of life with warfarin. CONCLUSION: Cardioversion followed by low-dose amiodarone to maintain normal sinus rhythm appears to be a relatively safe and effective treatment for patients with chronic atrial fibrillation. (Abstract by: Author)


To identify clinical predictors of last-minute preoperative cardiology consultations and to evaluate the impact of these consultations on patient care, we performed a retrospective case-control study including all 166 patients who received unscheduled cardiology consultations at the preadmission testing center (PATC) of an urban teaching hospital. Control subjects were 166 patients matched by date and category of surgical procedure. Significant (p < 0.05) independent predictors of last-minute consultations included history of myocardial infarction (odds ratio [OR] = 23.7; 95% confidence interval [CI] = 1.5 to 373), history of chest pain (OR = 15.3; 95% CI = 3.7 to 62.9), history of chronic obstructive lung disease (OR = 5.9; 95% CI = 1.1 to 32.9), prior echocardiography (OR = 3.4; 95% CI = 1.2 to 9.8), and age (OR per decade = 1.1; 95% CI = 1.04 to 1.1). Thus among patients undergoing elective noncardiac surgery, last-minute preoperative consultations are common and are usually precipitated by an abnormal electrocardiogram or history of cardiovascular disease. Last-minute consultations may be preventable if those patients with risk factors for consultation are identified in advance of the preadmission evaluation and referred for elective consultation.


The Stanford Five-City Project is a large experimental field study of community health education for the prevention of cardiovascular disease. It will provide data on fundamental questions in cardiovascular disease epidemiology, communication, health education, behavior change, and community organization, and will also test the ability of a potentially cost-effective program to prevent cardiovascular disease at the community level. This paper describes the purposes, hypotheses, design, and methods of the Five-City Project as a reference for future papers describing results. It is hypothesized that a 20% decrease in cardiovascular disease risk will lead to a significant decline in cardiovascular disease event rates in two treatment communities compared with three reference communities as a result of a six-year intervention program of community-wide health education and organization. Risk factor change will be assessed through four surveys of independent samples and in a repeatedly surveyed cohort. Cardiovascular disease event rates will be assessed through continuous community surveillance of fatal and nonfatal myocardial infarction and stroke. (Abstract by: Author)


The Stanford Five-City Project is a long-term field evaluation of the effects of community health education on cardiovascular disease risk factors and event rates. One major end point of the project is the difference between treatment and control group trends in morbidity and mortality rates ascertained through community-wide surveillance of deaths and hospital
discharges. This surveillance system includes continuous review of death certificates and hospital discharge records, interviews with the families and physicians of decedents who died outside the hospital, abstraction of the hospital records of possible myocardial infarction and stroke cases (fatal and nonfatal), and systematic validation of diagnosis by the use of standard criteria. Initial experience with information access, availability of diagnostic information, costs, and reliability are described. This standardized approach to community surveillance of cardiovascular disease events rates, both fatal and nonfatal, is a feasible method for evaluating large-scale intervention programs and may be applicable to monitoring secular trends in the absence of intervention. (Abstract by: Author)


Cardiology consultations are often requested by surgeons and anesthesiologists for patients with cardiovascular disease. There can be confusion, however, regarding both the reasons for a consultation and their effect on patient management. This study was designed to determine the attitudes of physicians toward preoperative cardiology consultations and to assess the effect of such consultations on perioperative management. A multiple-choice survey regarding the purposes and utility of cardiology consultations was sent to randomly selected New York metropolitan area anesthesiologists, surgeons, and cardiologists. In addition, the charts of 55 consecutive patients aged >50 yr., who received preoperative cardiology consultations were examined to determine the stated purpose of the consult, recommendations made, and concordance by surgeons and anesthesiologists with cardiologists’ recommendations. Of the 400 surveys sent to each specialty, 192 were returned from anesthesiologists, 113 were returned from surgeons, and 129 were returned from cardiologists. There was substantial disagreement on the importance and purposes of a cardiology consult: intraoperative monitoring, “clearing the patient for surgery,” and advising as to the safest type of anesthesia were regarded as important by most cardiologists and surgeons but as unimportant by anesthesiologists (all P < 0.05). Most surgeons (80.2%) felt obligated to follow a cardiologist's recommendations, whereas few anesthesiologists (16.6%) felt so obligated (P < 0.05). The most commonly stated purpose of the 55 cardiology consultations examined was "preoperative evaluation.” Only 5 of these (9%) were obtained for patients in whom there was a new finding. Of the cardiology consultations, 40% contained no recommendations other than "proceed with case," "cleared for surgery," or "continue current medications." Recommendations regarding intraoperative monitoring or cardiac medications were largely ignored.

IMPLICATIONS: We conclude that there seems to be considerable disagreement among anesthesiologists, cardiologists, and surgeons as to the purposes and utility of cardiology consultations. A review of 55 consecutive cardiology consultations suggests that most of them give little advice that truly affects management.


In 1972 the Stanford Heart Disease Prevention Program launched a three-community field study. A multimedia campaign was conducted for two years in two California communities (Watsonville and Gilroy), in one of which (Watsonville) it was supplemented by an intensive-instruction program with high-risk subjects. A third community (Tracy) was used as a control. The campaigns were designed to increase participants’ knowledge of the risk factors for cardiovascular disease, to change such risk-producing behavior as cigarette smoking, and to decrease the participants' dietary intake of calories, salt, sugar, saturated fat, and cholesterol. Results of a sample survey indicate that substantial gains in knowledge, in behavioral modification, and in the estimated risk of cardiovascular disease can be produced by both
methods of intervention. The intensive-instruction program, when combined with the mass-medica campaign, emerged as the most effective for those participants who were initially evaluated to be at high risk. The results after two years of intervention are reported for effects on knowledge and behavioral change for the total participant samples and for the high-risk subsamples in each of the three communities. (Abstract by: Author)


The purpose of this study was to document early mortality, perioperative complication rate, duration of hospitalization, and costs related to coronary artery bypass graft (CABG) surgery in the elderly. Arbitrarily, elderly patients were defined by age greater than or equal to 65 years; younger patients were less than or equal to 60 years old. A detailed list of specific perioperative complications was analyzed. Early (30-day) mortality was similar between groups, while 120-day mortality was higher among elderly compared with younger patients (7.6% versus 1.3%; *p* = 0.05). The number of elderly patients with 1 or more complications was also higher than among the younger patients (62% versus 43%; *p* = 0.05). When the incidences of atrial arrhythmias and transient psychoses were considered minor complications and excluded from consideration, the incidence of major complications was higher in the elderly: 41 major events among 76 younger surviving patients compared with 89 major complications in 61 older surviving patients (*p* = 0.001). Time spent in the intensive care unit and the duration of postoperative hospitalization were also greater in the elderly (*p* = 0.01 and *p* = 0.001, respectively). Finally, the elderly group incurred greater costs than the younger patients (*p* = 0.03). The likelihood of increased perioperative morbidity in elderly patients is documented in this study. Also, it appears that the increased frequency of complications in elderly patients is associated with a longer hospital stay and greater financial expense. Consequently, the careful preoperative evaluation of these patients, including cautious patient selection, assumes greater importance. After CABG procedures, the highly symptomatic elderly patient may experience dramatic relief of symptoms. Another goal of such surgery should be to optimize the quality of life. If these aims can be achieved, the greater utilization of hospital resources and the expense associated with CABG in the elderly may be justified. (Abstract by Author)


The requirements of 500 general practitioners from a hospital department of cardiology were sought and assessed from a questionnaire. One hundred and twenty two general practitioners caring for 766,384 patients responded. The most important inpatient service requirement was that cardiologists should be responsible for the management of patients with acute myocardial infarction and other acute cardiac conditions. The expertise and reputation of the consultant cardiologist and the waiting time for an appointment were the two most important outpatient service requirements. The least important aspect was the time patients waited in clinic to see a doctor. Fundholders considered price of outpatient consultations to be unimportant. Waiting times for cardiac catheterisation and non-invasive cardiac investigations together with the quality of the investigation equipment and the technical staff were all considered to be important requirements. Most general practitioners wanted protocols for managing common cardiac conditions. The majority wanted an open access investigation service to reduce outpatient waiting times. Those who did not want an open access service explained that they would not be confident in interpreting the results or deciding subsequent management. An understanding of the requirements of general practitioners is helpful in planning and developing hospital services.

BACKGROUND: The rapid expansion of managed care in the United States has increased debate regarding the appropriate mix of generalist and specialist involvement in medical care. OBJECTIVE: To compare the quality of medical care when generalists and cardiologists work separately or together in the management of patients with acute myocardial infarction (AMI). METHODS: We reviewed the charts of 1716 patients with AMI treated at 22 Minnesota hospitals between 1992 and 1993. Patients eligible for thrombolytic aspirin, beta-blockers, and lidocaine therapy were identified using criteria from the 1991 American College of Cardiology guidelines for the management of AMI. We compared the use of these drugs among eligible patients whose attending physician was a generalist with no cardiologist input, a generalist with a cardiologist consultation, and a cardiologist alone. RESULTS: Patients cared for by a cardiologist alone were younger, presented earlier to the hospital, were more likely to be male, had less severe comorbidity, and were more likely to have an ST elevation of 1 mm or more than generalists' patients. Controlling for these differences, there was no variation in the use of effective agents between patients cared for by a cardiologist attending physician and a generalist with a consultation by a cardiologist. However, there was a consistent trend toward increased use of aspirin, thrombolytics, and beta-blockers in these patients compared with those with a generalist attending physician only (P<.05 for beta-blockers only). Differences between groups in the use of lidocaine were not statistically significant. The adjusted probabilities of use of thrombolytics for consultative care and cardiologist attending physicians were 0.73 for both. Corresponding probabilities were 0.86 and 0.85 for aspirin and 0.59 and 0.57 for beta-blockers, respectively. CONCLUSIONS: For patients with AMI, consultation between generalists and specialists may improve the quality of care. Recent policy debates that have focused solely on access to specialists have ignored the important issue of coordination of care between generalist and specialist physicians. In hospitals where cardiology services are available, generalists may be caring for patients with AMI who are older and more frail. Future research and policy analyses should examine whether this pattern of selective referral is true for other medical conditions.

Dermatology


BACKGROUND AND DESIGN: This study determines (1) the readiness of primary care physicians (PCPs) to triage optimally lesions suspicious for skin cancer, (2) the difference in their abilities from those of dermatologists, and (3) whether accurate diagnosis after viewing slide images transfers to accurate diagnosis after viewing lesions on patients. Seventy-one primary care residents and 15 dermatologists and resident dermatologists diagnosed and selected a treatment/diagnostic plan for skin lesions suspicious for cancer. The lesions were shown on slides, computer images, and patients. Participants’ performance was compared with biopsy results of all lesions. RESULTS: Dermatologists’ scores were almost double those of primary care residents, and primary care residents' performance was positively associated with previous experience in dermatology. Primary care residents failed 50% of the time to diagnose correctly nonmelanoma skin cancer and malignant melanomas, and 33% of the time they failed to recommend biopsies for cancerous lesions. Primary care residents failed to diagnose malignant melanomas 40% of the time; dermatologists failed to do so 26% of the time. Both groups performed better using slide images compared with patients. CONCLUSIONS: Primary
care residents may not be ready to assume a gatekeeper role for lesions suspicious for skin cancer. Because of the seriousness of missed diagnoses, especially of malignant melanomas, we need to improve the triage skills of PCPs. Future studies should evaluate whether primary care training allows sufficient time for PCPs to learn the necessary skills. Until we can show that PCPs are prepared to triage optimally, managed care plans should reduce the threshold for referrals to dermatologists of potential skin cancers.


See Applications to Telemedicine—Outcomes.


See Applications of Telemedicine—Outcomes.


See Applications to Telemedicine—Satisfaction and Acceptance.


See Applications to Telemedicine—Satisfaction and Acceptance.


See General Telemedicine—General Descriptive.

Emergency Medicine


A telemedicine link was set up between the casualty department of a remote community hospital and the accident and emergency department of a large urban hospital. The telemedicine link comprised teleradiology, videoconferencing and telepresence. The system was connected by ISDN (128 kbit/s) and also by a satellite link (64 kbit/s). During a one-year clinical trial, 120 teleconsultations took place between the community hospital and the specialist trauma centre, 110 using ISDN and 10 using the satellite link. Teleradiology was used in 116 teleconsultations, videoconferencing in 76, and telepresence in four. Survey results indicated that both the general practitioners running the community hospital and accident and emergency consultants felt that teleconsultation had improved patient care. Communication between clinicians using the telemedicine link avoided the transfer of 70 patients, representing an estimated cost saving of Pounds 65,000.


BACKGROUND: Care of the patient injured in the rural setting poses many unique challenges. This report profiles the experience of a solo, rural general surgeon with patients with multiple injuries during a 7-year period. METHODS: Emergency department (ED) contact
sheets for 43,308 patients treated from September 1, 1988 through August 31, 1995 were reviewed. Eighty-four patients met selection criteria based on injuries with Abbreviated Injury Scale score $> 3$ in a single body region or $> 2$ in two or more body regions. Pre-hospital and hospital records were reviewed. RESULTS: Injury Severity Score ranged from 8 to 43 (mean, 16). Four patients died in the ED, 54 (64%) were transferred to a referral trauma center, and 26 (31%) were admitted to the community hospital. CONCLUSIONS: Roles of the general surgeon in the management of multiple trauma in the rural hospital are: (1) to coordinate trauma care in the community, including educational and organizational efforts; (2) to perform the necessary techniques in the ED to achieve optimal resuscitation and stabilization; (3) to rationally prioritize patients for transfer to a referral trauma center based upon assessment of patient injuries and institutional capabilities; and (4) to provide definitive care for a subset of patients with no need for subspecialty intervention. (Abstract by: Author)


The development of a statewide trauma system will depend on designation of community hospitals as trauma centers. The financial impact of such designation will be a prime concern. The payor mix of trauma patients will be one of the deciding factors as to whether hospitals will agree to accept designation. A three-year review of payor class on discharge for 2,605 trauma and 55,041 nontrauma admissions to a nonuniversity teaching hospital is presented. Sixty-four percent of all trauma admissions had third-party payor insurance coverage, compared with 72% of all nontrauma admissions (P less than .00001). Twenty-seven percent of trauma admissions were for penetrating injury. Sixty-eight percent of patients admitted for blunt trauma had third-party coverage, while 50% of those admitted for penetrating trauma had third-party coverage. Total commercial insurance coverage was higher for trauma patients than for nontrauma admissions. The payor class mix for trauma patients presented may be representative of similar institutions in a similar geographic setting and may offer assistance to hospitals considering the financial impact of trauma center designation. (Abstract by: Author)


OBJECTIVE: To examine the characteristics of patients transferred from a rural hospital emergency department, to compare them with patients admitted on an emergency basis, and to use this information to help plan physician education. DESIGN: Descriptive study using records for the period January 1, 1991, to June 30, 1992. SETTING: The emergency department at Bonnyville Health Centre, an acute care rural hospital located 240 km northeast of Edmonton, serving a catchment population of approximately 10,000. PARTICIPANTS: One thousand fifty-five patients seen in the emergency department who were either transferred to another centre or admitted to the Bonnyville Health Centre on an emergency basis. MAIN OUTCOME MEASURES: For the transferred group, main diagnosis, category of transfer, and reason for transfer. For the admitted group, main diagnosis, length of stay, type of discharge. RESULTS: Of the 1055 patients ill enough to be either admitted or transferred, 114 (10.8%) were transferred. Those transferred were predominantly men, the elderly, and people with orthopedic injuries or neurologic diseases. Those admitted presented primarily with internal, respiratory, gynecologic, or pediatric disorders. Reason for transfer was mainly lack of specialized services or equipment at the rural hospital. CONCLUSIONS: Patients transferred out of the emergency department differed from those admitted in diagnoses and sex. Most transfers were considered "mandatory." Results of this analysis supported incorporating a formal rotation in orthopedics.
and adding 4 weeks to the existing emergency medicine rotation in our family medicine residency program.  (Abstract by: Author)


There is a widespread perception that many trauma centers are poorly reimbursed, and many hospitals that once cared for trauma victims no longer do so, primarily for financial reasons.  The problem is blamed on both uninsured and underinsured patients, but data supporting this perception are lacking.  To determine the validity of these perceptions and to better understand the nature of trauma center reimbursement, a survey was conducted.  A questionnaire on the volume of trauma seen annually and the reimbursement experience for trauma center (TC) and hospital (HO) patient populations was mailed to representative but nonrandomly chosen trauma centers.  Seventy-one surveys were mailed and 25 were returned (35%).  There were 15 Level I and 10 Level II centers; 16 were urban, seven were suburban, and two were rural.  Eighteen centers (72%) reported significant underfunding of the TC in contrast to the HO, and 11 indicated that they would not be able to continue their current level of TC services with present reimbursement.  For Medicare patients, HO cost recovery rates averaged 93%, but recovery rates were only 64% for TCs.  For Medicaid beneficiaries, the HO cost recovery rate averaged 85%, but it was only 49% for TCs.  Thirty-one percent of TC patients had no insurance coverage at all, in contrast to only 9% of HO patients.  An aggregate loss equal to 19.9% of total costs was reported by respondents.  This survey, while not representative of trauma centers as a whole throughout the United States, does suggest that there is a basis for the perception of underfunding of trauma care and indicates that such underfunding results from the combination of adverse selection and disproportionate share.  We also describe a new method for assessing and comparing trauma center reimbursement.  (Abstract by: Author)


Use of the Emergency Department (ED) for nonurgent conditions results in increased cost and discontinuous health care.  This prospective study evaluated a program (KenPAC) that required 24-hour access to a primary care physician (PCP) with ED gatekeeping responsibility.  Following established criteria, medical records were reviewed for appropriateness of ED use by an urban indigent pediatric population.  Emergency Department visits declined (10% to 7.6% (P = 0.00005) and inappropriate visits dropped (41% to 8%) (P < 0.00001) before KenPAC and after KenPAC, respectively.  Parental experience, as judged by age and number of children, played a significant role in ED use.  The institution of gatekeeping activity contributed to the reduced overall and inappropriate use of the ED.


BACKGROUND AND OBJECTIVES: Medicaid recipients without a regular source of care frequently use hospital emergency departments (EDs) for minor problems.  This study examined whether referring Medicaid patients to primary care physicians and obstetricians results in a decrease in ED use and an increase in physician office visits.  METHODS: The statewide Voluntary Initiative Program (VIP), which referred Medicaid patients to primary care physicians and obstetricians without any managed care component, was examined.  Claims data were reviewed for Medicaid clients 0-64 years old who obtained VIP referrals during the first 5 months of the program.  The change in rate of visits to hospital EDs and physician offices was compared for the study group (n = 444) and for the state's overall Medicaid population (n = 40,860).  RESULTS: After referral, ED use decreased 24% for the VIP group and 4% for the
Medicaid population. During the same period, physician office visits increased 50% for the VIP group but decreased 13% for the Medicaid population. CONCLUSIONS: Even in the absence of managed care, referral to primary care physicians and obstetricians resulted in fewer ED visits and more physician office visits. These findings confirm the importance of primary care in improving the efficiency of health care delivery for the Medicaid population.


OBJECTIVES: To compare differences in response times, scene times, and transport times by advanced life-support-trained paramedics to trauma incidents in urban and rural locations.

METHODS: This report was a prospective cohort study of professional emergency medical services conducted in a five-county area in the state of Washington. Ninety-eight percent of trauma transports are provided by professional paramedics trained in advanced life support. Subjects were included in this study if they qualified as a major trauma victim and were transported or found dead at the scene by one of the region's advanced life support transport agencies between August 1, 1991, and January 31, 1992. The severity of injury was rated using the Prehospital Index. Incident locations were defined as "rural" if they occurred in a US Census division (a geographic area) in which more than 50% of the residents resided in a rural location.

RESULTS: During the 6-month data collection period, advanced life support agencies responded to a total of 459 major trauma victims in the region. A geographic locations was determined for 452 of these subjects. Of these, 42% of subjects were injured in urban areas and the remainder in rural areas. The severity of injuries, as determined both by the triage classification (p = 0.17) and the distribution of Prehospital Index scores (p = 0.92), was similar for urban and rural major trauma patients. Twenty-six (5.7%) subjects died at the scene. About one quarter of both groups had a severe injury, as indicated by Prehospital Index score of more than 3. The mean response time for urban locations was 7.0 minutes (median = 6 minutes) compared with 13.6 minutes (median = 12 minutes) for rural locations (p < 0.0001). The mean scene time in rural areas was slightly longer than in urban areas (21.7 vs. 18.7 minutes, p = 0.015). Mean transport times from the scene to the hospital were also significantly longer for rural incidents (17.2 minutes vs. 8.2 minutes, p < 0.0001). Rural victims were over seven times more likely to die before arrival (relative risk = 7.4, 95% confidence interval 2.4-22.8) if the emergency medical services' response time was more than 30 minutes. CONCLUSIONS: Response and transport times among professional, advanced life-support-trained paramedics responding to major trauma incidents are longer in rural areas, compared with urban areas. (Abstract by: Author)


The socio-economic costs of traffic road accidents were analyzed data epidemiological studies and compared with reported data. The costs are calculated as a function of accident type and vehicle involved, severity of head trauma, patients individual characteristics, type of care-intensive and emergency services, other hospital bed costs, including recovering and rehabilitation such as in-and out-patient services. Finally the costs of repairing materials (cars, walls, roads, etc.) are also estimated. The author concludes that the medical doctor must take part in compiling the statistics so as to be able to discuss the economics of injury and the social priorities.

In suburban and rural counties, patient transport to specialized facilities such as trauma centers may result in prolonged transport times with the resultant loss of ambulance coverage in the primary service area. We evaluated the American College of Surgeons trauma triage criteria as modified by New York State to determine the ability of these criteria to predict the need for trauma center care in victims of blunt traumatic injury. Blunt trauma patients were retrospectively identified through review of patient care reports for the presence either of mechanism or of physiological criteria for transport to a trauma center. Controls were randomly selected from patients with blunt trauma not meeting any of the criteria. Main outcome parameters were the emergency department (ED) disposition, length of hospital stay, need for intensive care unit (ICU) care, and major nonorthopedic operative interventions. There were 857 patients enrolled. The presence either of mechanism or of physiological criteria increased the likelihood of hospital admission (control, 11%; mechanism, 35%; and physiological, 33%). Relative to patients without any criteria, the presence of mechanism criteria alone did not identify patients who required a prolonged length of stay (67% vs 71%), intensive care unit services (13% vs 19%) or major nonorthopedic operative interventions (0.2% vs 1.6%). The presence of physiological criteria increased the likelihood of requiring all of these services. These comparisons held true for victims of motor vehicle accidents, pedestrians struck by motor vehicles, and people who fell from heights above ground level. Patients with physiologic criteria may benefit from transport directly to a trauma center. Because of the low need for operative intervention and ICU services, patients with no criteria or mechanism criteria at long distances from a trauma center may be initially evaluated at the closest hospital and transferred to a trauma center if hospitalization or ICU care is necessary. Further study to determine the predictive value of certain individual mechanism criteria is warranted.


HYPOTHESIS: Alcohol is a major factor in ambulance responses in rural Alaska; alcohol-related emergencies significantly increase the expense of operating an advanced life support ambulance service. METHODS: A prospective analysis was performed on emergency medical responses one year, ending September 30, 1997. Data were collected from medical records, police documents, and court records. ANALYSIS: Each ambulance response was analyzed for the presence of alcohol. The departmental budget was reviewed to separate out fixed and variable costs. Between these analyses, a determination was made regarding the actual cost of all alcohol-related ambulance responses. RESULTS: Six hundred eighty-one patients were included for study. Alcohol was a factor in one hundred ninety-one (28.0%) of these patients. The cost to the community for alcohol-related responses amounted to $81,503, representing 19.2% of the budget. CONCLUSION: The cost to respond to alcohol-related emergencies represents a significant fraction of Ketchikan’s total emergency medical budget. (Abstract by: Author)


STUDY OBJECTIVE: Two widely used formulas for calculating the number of practicing emergency physicians (EPs) are based on the total number of US emergency departments and patient visits. In this study we hypothesized that the number of physicians now working in EDs is significantly greater than the estimates yielded by these formulas. Therefore we attempted to determine the accuracy of these methods for predicting the true number of practicing EPs. We also examined the training, board certification, and distribution of EPs. METHODS: The EDs of
all hospitals listed by the Missouri Hospital Association (MHA), excluding children's and psychiatric hospitals, were surveyed over a 9-month period in 1994 with regard to the number and board status of all physicians practicing in their EDs and the numbers of full-time equivalents (FTEs) required for adequate staffing. These numbers were compared with 1994 estimates for Missouri based on two common methods of calculation. RESULTS: Of 134 hospitals with EDs, 118 (88%) completed our survey. These EDs employed 458 full-time EPs and 690 part-time EPs, with 41% and 7% board-certified in emergency medicine, respectively. Board-certified emergency physicians were concentrated in large cities and at university hospitals and were sparsely represented in rural areas. Adequate staffing of these EDs required 677 FTEs, compared with estimates of 358 (formula A) and 555 (formula B). Previously published formulas underestimate the need for EPs in our state by 47% (formula A) or 18% (formula B). CONCLUSION: Current staffing estimates regarding EPs working in Missouri greatly underestimate actual staffing needs. Board-certified EPs are in severe shortage and are unequally distributed in Missouri. Extrapolated nationally, these estimates may negatively affect funding and available residency positions for emergency medicine.


BACKGROUND: The evacuation of emergency cases by air, usually by helicopter, is controversial because of the cost of the programme, the possibility of an accident (especially in an urban area), and unproven benefit. But such evacuations cannot be studied by a random intervention (eg, air versus ground ambulance). We used an expert-panel approach to estimate the health outcome for patients transferred by emergency helicopter compared with the potential outcome if they had gone by surface ambulance. METHODS: The helicopter programme is based at the University Hospital of Tromso in northern Norway. 370 case-reports of helicopter evacuation from rural areas were screened by anesthetists for routine and case-specific data. Two expert panels assessed the cases for potential additional health benefit arising from the fact of helicopter evacuation. The panels used a modified Delphi technique to reach consensus in life-years gained. One panel met for cases aged under 15 and pregnant women, the other for older cases. FINDINGS: 240 of the 370 cases were male (65%); the age range for both sexes was 0-86 years. The most common diagnosis for the 55 cases aged under 15 was infection (49%); in older patients, cardiovascular disease dominated (50%). Trauma accounted for just under a fifth of cases in both groups. On average, the patients arrived 69 min (range 0-615) earlier in hospital than if they had gone by ground transport. For 283 cases, the initial screening by the anesthetists indicated no additional benefit compared with that obtainable by ground-ambulance transport. The main reason was that no treatment was given during the flight or early on in hospital that could not have been given otherwise. 90 cases entered the expert panel system. Of these 90, 49 cases were judged to have received no additional benefit. This left 41 (11% of the total of 370 evacuated) who were judged to have benefited, gaining 290.6 life-years. 96% of the total number of life-years gained was achieved in nine patients, six of whom were aged below 7 (four were aged 0-7 months). The life-year-gain per adult patient with cardiovascular disease was 0.54. INTERPRETATION: We conclude that an emergency helicopter service can provide considerable health benefits for selected patients, at least in this rural setting. Given the costs and risks of such a service, the benefits for most patients are small.


OBJECTIVE: To determine the preventable death rate (PDR) and the frequency and types of inappropriate medical care in a large, rural region of Michigan. DESIGN: A prospective study of all deaths caused by injury during a 1-year period. METHODS: Preventability of death
and appropriateness of care were determined using a structured implicit review process and expert panel. A second panel was convened to confirm the reliability of the review process.

**MAIN RESULTS:** One hundred fifty-five injury-related deaths underwent panel review. Four deaths (2.6%) were found to be definitely preventable and 16 (10.3%) possibly preventable, for a combined preventable death rate of 12.9%. Sixty-five deaths (41.9%) occurred in the emergency department or hospital; 18 of these (27.7%) were judged to be definitely preventable or possibly preventable. Forty-three episodes of inappropriate care were identified in 27 (17.4%) of the 155 cases reviewed. These occurred primarily in the emergency department and hospital rather than during prehospital care or transfer. **CONCLUSIONS:** A relatively small percentage of trauma fatalities in rural Michigan could have been prevented by more appropriate or timely medical care. Efforts to improve the care of injured persons in rural Michigan should be directed primarily at the emergency department and inpatient phases of trauma system care.


This study summarizes all 2,550 trauma-related rural ambulance trip reports filed for the period January 1 through December 31, 1991 from the 12 rural counties surrounding Augusta, Georgia. There were 13.1 trauma-related ambulance runs per 1,000 population. Nearly one third of all rural ambulance runs are trauma related. Severe trauma constituted less than 8.0% of trauma cases. Forty-one cases died at the scene and 19 additional cases died from any cause within 30 days of transport. The mean response time was 8.5 minutes and in 90% of all rural trauma runs the ambulance arrived in 17 minutes or less. Only 51.5% of runs had a rural hospital as a destination, 14.2% went directly to a trauma center, and nearly 20% to another urban hospital. Of the 71 severe trauma cases received by ambulance, rural hospitals transferred out only 13 cases, most of these to the regional trauma center. Of the 47 trauma cases transferred to the trauma center, 33 were not severe.


**OBJECTIVES:** The authors determine whether assessments of effects of rural emergency medical services (EMS) system characteristics on trauma outcomes using patient-level data are biased significantly if the Injury Severity Score (ISS) is not available. **METHODS:** Data are taken from ambulance trip reports merged with the trauma registry data for the Georgia EMS region VI trauma center hospital, located in Augusta. All 294 trauma patients for the rural counties surrounding Richmond County for the calendar year 1991 who were not dead at the scene and who were treated at the trauma center are included. A 20% random sample of trauma patients from Richmond county from May 1991 to September 1991 not dead at the scene and treated at the trauma center yielded an additional 96 cases. Excluding 43 patients with missing data yields 347 trauma cases with 18 trauma deaths. A logistic regression model for trauma mortality is estimated using the Revised Trauma Score, ISS, type of trauma, and patient age (analogous to the standard Trauma Related Injury Severity Score model). The predicted probability of patient mortality from this model is compared with the predicted probability of mortality when the logistic regression model omits ISS. Correlations between the difference in predicted probability (ie, the error in predicted probability associated with the omitted ISS variable) and EMS system characteristics are determined. **RESULTS:** Although ISS adds to the predictive power of the trauma outcome model, the errors in predicted probabilities associated with the omission of ISS generally are small and uncorrelated with patient or EMS system characteristics, with the exception of patient gender. **CONCLUSIONS:** In rural settings, where a patient's ISS generally is not available, studies of rural EMS system characteristics and trauma outcomes may use Revised Trauma Score, patient age, and type of
trauma to control for expected survival. The patient's ISS does not appear to be essential, at least for the rural area analyzed in this study.


STUDY OBJECTIVE: To document the current epidemiology of pediatric injury-related deaths in a rural state and evaluate changes over time. DESIGN: Retrospective review of injury-related deaths in children less than 15 years of age. Data were obtained from death certificates and coroner, autopsy, prehospital, and hospital records. Analysis was done of the mechanism of injury, age, sex, race, location of incident, toxicology, and safety device use. Comparisons with analogous data collected from an earlier time period were made. SETTING: The state of Montana, from October 1989 to September 1992. MEASUREMENTS: Deaths per 100,000 population, intentionality of injury, mechanism of injury, use of protective devices, and comparisons with previous data (1980-1985) collected by Baker and Waller (Childhood injury: State by state mortality facts. Baltimore: Johns Hopkins Injury Prevention Center, 1989;148-152). RESULTS: Of 121 patients reviewed, 56% were male and 44% were female. Mean age was 7.0 years (median, 8.0). Eighty-one percent of patients were Caucasian, and 16% were Native American. The leading cause of injury was motor vehicle crashes, which was followed by drowning, unintentional firearm injuries, deaths related to house fires, homicides, and suicides. Overall, 87% of injuries were unintentional and 13% were intentional, with 62% of these suicides and 38% homicides. When considered independently of intent, firearm-related injuries ranked second. Earlier data showed motor vehicle crashes ranking second, unintentional firearm injuries seventh, and homicide fourth. Comparison of death rates per 100,000 people for the two time periods showed increases in suicide deaths (3.2 vs 0.8) and unintentional firearm injury deaths (2.3 vs 0.6). CONCLUSION: The epidemiology of rural pediatric injury-related deaths has changed. Deaths related to suicide and firearms have increased. Violent deaths related to injuries caused by firearms are at a magnitude approaching all other causes. These findings have implications for public health education and injury control strategies in rural areas.


PURPOSE: To study the impact of Level III verification and other changes in rural hospitals on trauma delivery and to examine factors affecting transfer to a Level I trauma center. SETTING: Two rural Kentucky hospitals and a Level I trauma center. METHOD OF REVIEW: Concurrent review of all trauma patients in 1988 and re-review of the same parameters in 1995. FINDINGS: In 1988, both hospitals had similar management practices in trauma care. A significant number of patients were transferred for (a) patient choice, (b) serious and/or multiple trauma, (c) specialty care in non-life threatening situations, and (d) to exclude a potentially serious problem seen on radiologic evaluation (usually questionable cervical spine or widened mediastinum). Both hospitals had major changes in trauma delivery. One hospital received Level III verification, and the other had changes that lessened the general surgeon's involvement with initial evaluation and treatment. A re-review in 1995 disclosed major changes at both institutions. Transfers to exclude radiologic abnormalities had virtually disappeared. The Level III status had increased the surgical involvement in that hospital; there was actually an increase in patients transferred to the Level I hospital and an increase in patient acuity. More operations were performed locally, and the care was more efficiently delivered. The other hospital had a large increase in transfers and decreased admissions locally as general surgical involvement decreased. CONCLUSIONS: The factors related to patient transfer for trauma care are complex and require careful elucidation to improve care. The development of a Level III
trauma service appeared to increase the number of seriously injured patients treated in the rural hospital and the efficiency of the care delivered.


**BACKGROUND:** Missed injuries can lead to delays. In the rural environment, where patients are frequently seen in multiple hospitals prior to reaching the trauma center, different problems arise. **METHODS:** Level-1 trauma center admissions from January 1993 through June 1995 were reviewed. Missed injuries were those not identified within 24 hours of injury. Data extracted included demographics, mechanism, severity and outcome. Comparisons were made between missed injury patients and typical trauma patients. **RESULTS:** Of 3,996 patients, 70 missed injuries were identified in 56 patients. Compared with typical trauma patients, missed injury patients suffered more blunt trauma, were more severely injured, had longer intensive care unit and hospital stays, and a lower mortality rate. Transferred patients accounted for 60% of missed injuries. **CONCLUSIONS:** Transferred patients with blunt injury have the highest risk for missed injury. Delayed transports and prior examination may contribute to complacency. All trauma patients must be repeatedly evaluated thoroughly, and all diagnostic studies reviewed for adequacy.


The financial plight of the urban trauma center is well documented. However, the financial status of the rural trauma center is largely unknown. We hypothesized that our rural trauma center with a high number of blunt trauma patients, a wide spectrum of injury severity, and a large percentage of insured patients would prove to be financially advantageous to the institution. From January 1994 to June 1995, 1,119 consecutive trauma admissions had a complete financial profile compiled including actual costs, reimbursements, and reimbursement ratio (RR = reimbursement/actual costs). Our injury severity profile was very skewed with a preponderance of less severely injured patients (mean Injury Severity Score = 9.6 +/- 7.8). The payor profile of these patients included 49.2% fee-for-service (RR = 1.43), 25.4% diagnosis-related group-based (RR = 0.92), 8.77% per diem (RR = 0.51), and 1.25% capitated (RR = 0.47). Overall, the RR for the trauma unit was 1.11, representing a net profit overall. Cost closely tracked both hospital and intensive-care unit length of stay (R2 = 0.925). Likewise, reimbursement also was reflected in both hospital and intensive-care unit length of stay (R2 = 0.735). We conclude that our rural trauma center, with a favorable payor mix and low injury severity, is financially profitable.


**OBJECTIVE:** To determine the characteristics and outcome of transferred trauma patients in a rural setting. **METHODS:** We conducted a case-control study of all trauma admissions to a rural Level I trauma center to examine a 3.5-year (1993-1996) comparison of trauma patients admitted directly with those transferred (RTTP) after being initially stabilized at an outlying hospital. We used prehospital times, Injury Severity Score (ISS), LD50ISS (the ISS at which 50% of patients died), Revised Trauma Score, probability of survival, Acute Physiology and Chronic Health Evaluation II, and observed survival as main outcome measures. **RESULTS:** RTTPs (39.4%) spent an average of 182 +/- 139 minutes at the outlying hospital and 72 +/- 42 minutes in transport to the trauma center. Proportionately more head/neck and patients with multiple injuries composed the RTTP group. The RTTP were more severely injured (ISS 11.1 +/- 8.5; Acute Physiology and Chronic Health Evaluation II 16.2 +/- 5.8; Revised Trauma
Score 7.44+/−1.1) than the trauma patients admitted directly (ISS 7.9+/−5.3; Acute Physiology and Chronic Health Evaluation II 13.1+/−6.3; Revised Trauma Score 7.8+/−0.4; p < 0.05). However, both groups had the same LD50ISS (ISS = 35). When logistic regression was applied with death as the dependent variable, both ISS and age contributed significantly (p = 0.0001) but transfer status did not (p = 0.473). CONCLUSION: Rural trauma centers admit a high percentage of RTTP. These RTTP have a higher injury severity and acuity than their trauma patients admitted directly counterparts. Trauma care in rural areas that involves initial stabilization at outlying hospitals does not adversely affect mortality.


OBJECTIVE: To compare the timing, severity, and injury characteristics of patients dying from trauma in an urban vs a rural setting. DESIGN: Retrospective review of autopsy database (urban) and medical examiner database (rural), with selected medical chart review. SETTING: An organized urban trauma system with 6 trauma centers and a rural state with no formal trauma system and 1 trauma center. PATIENTS: All trauma fatalities occurring in an urban (n = 612) and a rural (n = 143) setting during a 1-year period. RESULTS: In the urban system, 248 patients (40.5%) died at the scene of injury compared with 103 (72%) patients in a rural environment. During the first 24 hours of hospitalization 243 (39.7%) urban patients died compared with 23 (16%) rural patients. Eighty-nine urban patients (14.5%) and 17 rural patients (11.8%) survived for more than 24 hours but later died in the hospital. The mean age of those who died was significantly greater in the rural trauma system than in the urban trauma system (P < .001), and the Injury Severity Score was significantly less in the rural trauma system than in the urban trauma system (P < .01). In the patients who died after being admitted to the hospital for more than 24 hours there was a significantly higher rate of preexisting comorbidity in the rural patients than in the urban patients (P < .05). The most frequent cause of death in the rural setting was multisystem organ failure; head injury was the most common cause of death in the urban setting. CONCLUSIONS: Patients who die in a rural area without a formal trauma system are more likely to die at the scene, are less severely injured, and are older. Rural trauma patients who are admitted to a hospital and who survived for at least 24 hours before dying are older, less severely injured, have significantly more comorbidities, and are more likely to die of multisystem organ dysfunction than their urban counterparts. These differences reflect the different patient populations and injury patterns that confront urban and rural trauma centers. The higher proportion of scene deaths in the rural environment may reflect the longer discovery and transport times that occur in a rural setting.


American College of Surgeons triage guidelines recommend rapid identification and transfer of seriously injured patients to regional trauma centers, bypassing local hospitals if necessary. This approach raises concerns about the potential negative financial impact of implementing such triage strategies on already strained rural hospitals. OBJECTIVE: The purpose of this study was to determine the association between injury severity and reimbursement for trauma care in rural hospitals. It was our hypothesis that the seriously injured would be high cost and relatively low reimbursement patients, and thus be a significant financial liability to the rural hospital. This would imply that concerns by the rural hospital about triage of such patients to trauma centers would be unfounded. METHODS: Data on every injured patient seen in the emergency department during two 3-month periods were obtained from three rural hospitals in the state using the American College of Surgeons Trauma Registry data base. RESULTS: One thousand six hundred thirty patients had complete data available for analysis. The analyses demonstrated that as the injury severity increased, there was an
increase in hospital charges, length of stay, and risk of dying. In contrast, the reimbursement changed little as the charges and severity increased. Thus, hospital losses increased in an exponential fashion as injury severity increased above 15. CONCLUSION: The study demonstrates that as injury severity increases, costs and charges increase, but reimbursement does not keep pace with these increased charges. The rural hospital was projected to lose an average of $25,000 for each patient with an Injury Severity Score over 15. This study supports the rapid triage and transport of the seriously injured patient from the rural hospital to the regional trauma center both for improved patient outcome and for the hospital's best interest. The potential impact of such a system on the trauma center also needs to be addressed.

(Summary by: Author)


BACKGROUND: The purpose of the study was to compare the outcome of severely injured patients who were transported directly to a Level I, tertiary trauma center with those who were transferred after being first transported to less specialized hospitals. METHODS: The data were based on all patients treated at three tertiary trauma centers in Quebec between April 1, 1993, and December 31, 1995. There were 1,608 patients (37%) transferred and 2,756 patients (63%) transported directly. RESULTS: The mean age of the patients was approximately 45 years, and more than 60% were males. The predominant mechanisms of injury were falls and motor vehicle crashes. The transfer and direct transport groups were similar with respect to age, gender, and mechanism of injury. Body regions injured were also similar with the exception of head or neck injuries (transfer, 56%; direct, 28%; p < 0.0001). The mean Injury Severity Score was 14, the mean Pre-Hospital Index score was 5.5, and the mean Revised Trauma Score was 7.5. The two groups were similar with respect to these injury severity measures. The primary outcome of interest was mortality described as overall death rate, death rate in the emergency room, and death rate after admission. Other outcomes studied were hospital length of stay and duration of treatment in an intensive care unit. When compared with the direct transport group, transferred patients were at increased risk for overall mortality (transfer, 8.9%; direct, 4.8%; odds ratio, 1.96; 95% confidence interval (CI) = 1.53-2.50), emergency room mortality (transfer, 3.4%; direct, 1.2%; odds ratio, 2.96; 95% CI = 1.90-4.6), and mortality after admission (transfer, 5.5%; direct, 3.6%; odds ratio, 1.57; 95% CI = 1.17-2.11). All of these differences were statistically significant (p < 0.003). Stratified and multiple logistic regression analysis did not alter these results and failed to identify a patient subgroup for which transfer was associated with a reduced risk of mortality. After adjusting for patient age, Injury Severity Score, and presence of injuries to the head or neck and extremities, transferred patients stayed significantly longer in the hospital and the intensive care unit as indicated by the mean length of stay (transfer, 16.0 days; direct, 13.2 days; p = 0.02) and the mean intensive care unit stay (transfer, 2.0 days; direct, 0.95 days; p = 0.001). CONCLUSION: The results of this study have shown that transportation of severely injured patients from the scene directly to Level I trauma centers is associated with a reduction in mortality and morbidity. Further studies are required for the evaluation of transport protocols for rural trauma. Economic and cost-effectiveness considerations of patient triage are also essential. (Summary by: Author)


This study reviews all pediatric facial fractures treated operatively at the C.S. Mott Children's Hospital of the University of Michigan over a five-year period. Previous series of pediatric facial fractures have been collected at large urban centers and may not be representative of all practice environments. Our institution is a level 1 trauma center that serves
a patient population primarily from suburban and rural regions throughout the state. Referral and practice patterns at our institution gave us an important opportunity to analyze differences in patient care and management secondary to venue, and challenge the assumptions made by studies collected at large urban centers. We reviewed 80 fractures in 62 patients. Patient age ranged from 2 to 18 years old with the majority of patients (58%) between 15 and 18 years old. Most fractures resulted from motor vehicle accidents (43%) and there were no firearm injuries. Fracture sites included the mandible (38%), the frontonasal region (35%), the midface (17%), and the orbit (10%). Only two operative complications were reported. There were no cervical spine injuries. Median patient age was higher and mechanism of injury differed in our study compared with urban studies. Rapid changes in the health care delivery system and the emergence of managed care demand accurate demographic updates for the efficient allocation of valuable resources. Our results showed important differences with previous studies and imply that assumptions and analysis of the care of pediatric facial fractures based solely on data collected at large urban centers may be too parochial, and therefore subsequent health care decisions of resource allocation arrived at without respect to practice environment could be erroneous.


STUDY OBJECTIVE: To evaluate the effectiveness of a rural emergency medical and trauma services project in increasing the knowledge and confidence of emergency care personnel in the management of acutely ill and injured children. METHODS: This prospective, quasi-experimental study used an untreated control group design with pretest and posttest of pre-hospital and hospital-based emergency care personnel in two rural counties in central Ohio. Project evaluation compared 50 emergency care providers from the intervention county with 43 emergency care providers from the control county. Changes in knowledge and confidence of these personnel in the assessment and management of pediatric emergencies were compared. RESULTS: Providers in the intervention county demonstrated a significantly greater increase in test scores regarding knowledge of pediatric emergencies than did providers in the control county (P = .001). Significantly greater improvement was also seen when comparisons of test scores were made for field (P = .02) and hospital (P = .03) emergency care personnel separately. Self-reports on a visual analog scale indicated that providers in the project intervention county had a significantly greater decrease in anxiety than did control subjects when presented a scenario of a child experiencing a respiratory arrest (P = .01). On the basis of scores from a five-point Likert scale, emergency personnel in the intervention county had a greater increase in confidence regarding management of the pediatric airway (P = .0003) and a greater increase in the belief that they had adequate pediatric training (P = .000001) after participating in the project than emergency personnel in the control county. CONCLUSION: The rural pediatric emergency medical and trauma services project was effective in increasing the knowledge and confidence of emergency care personnel in the management of acutely ill and injured children. This project offers a model that can be replicated in other rural areas nationally. (Abstract by: Author)


In an effort to maximize staff utilization, all pediatric trauma patients were triaged by emergency room personnel to one of two tiers, based on information reported by prehospital providers over radiotelephones. A total of 952 patients less than 15 years of age were evaluated during a 1-year period. The triage criteria had a sensitivity of 86% in predicting which
trauma patients would require operating room and/or pediatric intensive care, while maintaining
a specificity of 90%. Fifteen patients died; however, by TRISS methodology there were no
unexpected deaths and four unexpected survivors. All eventual deaths were initially captured
from field data by the severely injured triage criteria. The study data suggest that physician-
controlled two-tiered field triage criteria can safely serve to maximize staff utilization in the
emergency room. (Abstract by: Author)


The cost estimates presented here are intended as a tool for assessing the magnitude of
the problems of crashes and index crimes, and, more importantly, evaluating the costs and
benefits of policy alternatives. These cost estimates, used in combination with other necessary
and valuable information, can assist decision makers confronting the problems of crashes and
crime and contribute to informed decisions about the allocation of limited resources.


STUDY OBJECTIVE: To examine medical and demographic factors associated with
traumatic deaths among children in Kentucky. METHODS: This was a retrospective review and
multiple regression analysis of all deaths in children younger than 18 years reported to the
Kentucky Office of Vital Statistics from 1988 to 1992. RESULTS: All 1,024 pediatric trauma
deaths that occurred from 1988 to 1992 were analyzed. Death rates were calculated for each
type of trauma for each county in the state. Motor vehicle accidents accounted for most of the
pediatric deaths, but this finding was markedly age dependent. Death rates were higher in rural
Kentucky for all forms of trauma and were highest in the Appalachian region. Multiple Poisson
regression analysis identified variables associated with the traumatic pediatric death rates.
Rural setting was associated with higher traumatic death rates, whereas the availability of a
hospital with 24-hour emergency services in the county and the presence of advanced life
support prehospital care were associated with lower death rates. Children in Appalachia were
at an increased risk compared with other Kentucky children, even when we controlled for the
rural nature of Appalachia. CONCLUSION: Demographic and medical system factors are
associated with traumatic death rates in Kentucky children. Access to care and advanced
prehospital support were both significantly associated with lower pediatric death rates.
Increased access to quality care and training of prehospital providers in advanced life support
should be priorities in the planning of trauma systems for this state.

System for Daily Routine and Emergency Cases--A Four-Year Study.” European Journal of

In January 1991, an image transfer unit was developed and installed in the neurosurgical
department of the University in Mainz. The system provides an image transfer of patient data via
fibreoptic cable networks (VBN), ISDN, and public telephone line. In the following 4 years, 432
consultations were recorded. Nine departments were linked within this system. They provided
an emergency out-patient department for primary treatment and radiology. The lack of a
neurosurgical department in these clinics was made up for by the image transfer system. In
these rural medical departments, teleconsultation improves the care of daily routine
neurosurgical cases, as well as in emergency cases. There is also a decrease of costs due to
teleconsultation. The image transfer via simple public telephone line was sufficient. (Abstract
by: Author)
Evaluating Telemedicine: An Analytic Bibliography


STUDY OBJECTIVE: To determine whether triage and stabilization of severely injured rural trauma victims in outlying Level III emergency departments before transfer to Level I trauma centers results in outcomes similar to national normative data. DESIGN: Retrospective review of trauma transfers and deaths during a 4-year period. SETTING: Two Level III EDs in rural, upstate New York and an urban Level I regional trauma center. PARTICIPANTS: Fifty multiple-trauma victims with a Trauma Triage Score (T-RTS) of \( < \) or \( \geq 11 \) or less. Forty-three patients were stabilized before transfer, and 7 died in the rural Level III ED. RESULTS: There were 45 blunt injuries and 5 penetrating injuries. Mean patient age was 34 years (range, 9 months to 97 years). The Revised Trauma Score (RTS) on admission to the Level III ED was calculated for each patient (median score, 5.97; interquartile range (IQR), 4.09 to 6.90), as was the ultimate Injury Severity Score (ISS) (median score, 23; IQR, 13 to 29). With TRISS methodology, probabilities of survival (Ps) and death (Pd) were calculated. Results were compared with the Major Trauma Outcome Study (MTOS) by use of current coefficients derived from Walker-Duncan regression analysis of MTOS data. The predicted number of deaths was 13.5, whereas the actual number was 12, Z statistic, -0.71. There were two unexpected survivors and three unexpected deaths. The 43 patients who were stabilized and transferred had a median RTS of 5.97 (IQR, 4.30 to 6.90) and an ISS of 18 (IQR, 12 to 25). The median interval in the Level III ED before transfer was 1 hour 43 minutes (IQR, 1 hour 11 minutes to 2 hours 40 minutes). There were two unexpected survivors (Ps = .32, Ps = .49) and 1 unexpected death (Ps = .52). The predicted number of deaths was 8.1, whereas the actual number was 5. The 7 patients who died in the rural Level III ED had a median RTS of 4.41 (IQR, 2.98 to 4.71) and a median ISS of 50 (IQR, 44 to 65). The median interval in the Level III ED before death was 42 minutes (IQR, 41 minutes to 1 hour 20 minutes). There were 2 unexpected deaths (Ps = .66, Ps = .55). The predicted number of deaths was 5.4 whereas the actual number was 7. CONCLUSION: Triage and stabilization of severely injured rural trauma victims at Level III EDs before Level I transfer provide outcomes similar to national results. Unexpected death of severely injured trauma victims remains a problem in rural Level III EDs.

(Abstract by: Author)


STUDY OBJECTIVE: To determine the degree of injury recidivism in our ED population and to identify indicators of injury recidivism. METHODS: We conducted a retrospective review in a university-affiliated department of emergency medicine. The study participants were patients who presented for treatment of an injury. An injury recidivist was defined as a patient who presented for treatment of two or more unique injuries during the 1-year study period. The injured population was divided into three categories: (1) those with a single injury visit, (2) those with two to three injury visits, and (3) those with four or more injury visits. Demographics, mechanism of injury, and outcome data were collected and comparative analyses performed. RESULTS: Of the 37,360 ED patient visits, 12,075 were injury related. Of the injury visit load, 2,838 of the 12,075 (24%) were injury recidivists. Of injured patients, 1,239 of 10,476 (12%) were recidivists. The sex distribution was similar among the groups, but the mean age decreased as the degree of recidivism increased. The degree of recidivism was higher for patients with Medicaid and for those who were uninsured. Lower mean medical charges per visit were found with increasing degree of recidivism, but the average total charges per patient increased with increasing degree of recidivism. Increasing degree of recidivism was associated with decreasing incidence of transportation-related injury but increased incidence of overexertion or intentional injuries. CONCLUSION: A small group of patients account for a
significant proportion of ED injury visits. In comparison with injury patients seen once during the year, recidivists represent a younger population of lower socioeconomic status, and they are at increased risk of intentional injury. (Abstract by: Author)


The purpose of organized trauma systems is to ensure the expeditious transfer of seriously injured patients to the facility best equipped to care for their injuries. Patients are referred to our trauma center, either by ambulance or helicopter, directly from the scene or through interhospital transfer. We examined the difference in outcome between those patients sent directly to the trauma center versus those seen at other hospitals and subsequently referred to the trauma center. Our hypothesis was that a delay at the referring hospital is detrimental to patient outcome. Adult trauma patients with Injury Severity Scores > 15, treated over 16 months from July 1, 1994, to October 31, 1995, were studied. Patients who survived 24 hours experienced significantly shorter intensive care unit (14 vs. 10 days; P < 0.05) and hospital (21 vs. 16 days; P < 0.05) lengths of stay when taken directly to the trauma center. In addition, there were significantly fewer deaths in patients with a probability of survival > 0.5 and a slightly lower overall mortality in those patients who survived at least 1 day. This study demonstrates that patients with major trauma taken directly to the trauma center had shorter hospital and intensive care unit stays and lower mortality. The study supports the paradigm that, when possible, major trauma patients should be sent to trauma centers directly from the injury scene.


The role of helicopters in trauma management must be considered in the context of the provision of sophisticated, high-quality trauma care. The present review examines the evolution of systems of trauma care, the value of advanced life support (ALS), and the role of the Helicopter Emergency Medical Service (HEMS) in improving outcomes. Comparison is made of outcomes of patients managed by HEMS and road ambulances, and important aspects of HEMS including staffing and safety are discussed. There is a role for HEMS as part of a modern trauma system, in particular in bringing ALS skills and access to expert medical care to the rural accident scene or hospital at distances of up to 160 km. It is of greatest value when it is integrated into a well-organized ambulance service and emergency system with good triage and close medical supervision. (Abstract by: Author)

Pharmacoeconomics


A decision model can be a useful tool for evaluating the cost-effectiveness of a drug during research and development, before the drug is marketed. Decision analysis provides a structured process for comparing the costs and consequences of a new drug with those of standard drug therapy. This article introduces the use of a decision model and discusses the advantages and disadvantages of such a model. A cost-utility study of nefazodone, a new antidepressant, illustrates the application and interpretation of decision models.
Functioning effectively as a pharmacy benefit manager has been defined as purchasing the best product at the lowest possible cost. In the simplest terms, this means purchasing discounted drugs; in the most complex terms, it means managing drug use. However, if the entire medical picture were analyzed, use of more expensive drugs might actually lower total direct medical costs. Currently, formulary decisions are based on both therapeutic necessity and cost. The decision to administer one drug, rather than another, is directed by community practice patterns and the final price. The availability of information to demonstrate differences, if any, in total treatment costs between the two agents would considerably enhance therapeutic decision-making and would guide treatment by an outcome-based drug formulary. The question that requires an answer is centered on the value equation: Value = outcomes/cost. Before paying more for drug A than for drug B, the payer will demand to see value. When available, direct and indirect cost information will be applied to position drugs appropriately in a drug formulary.


Patients with non-insulin-dependent diabetes mellitus (NIDDM) can present with an array of symptoms and complications directly or indirectly related to the disease. These impair the quality of life of the patient and also result in higher morbidity and mortality rates relative to the general population. Although diet and lifestyle measures are the cornerstone of management of NIDDM, the vast majority of patients will require pharmacological therapy. Metformin is an oral biguanide antihyperglycaemic agent which has been shown to be as effective as the sulphonylureas in lowering blood glucose levels in patients with NIDDM. Because it does not increase bodyweight and tends to improve the serum lipid profile, metformin can be considered a first-line therapy for NIDDM in patients who are obese and overweight (although it appears equally effective in nonobese patients) and those with dyslipidaemia. It may also be used in combination with sulphonylureas in cases of secondary failure. Thus, metformin should be considered an important drug for inclusion in the management protocols for NIDDM in all care facilities involved with such patients (Abstract by: Author)


An analysis was conducted on the basis of available data to assess the economic consequences of clozapine therapy for people with moderate to severe schizophrenia in long-stay institutions or staffed group homes, with a view to providing an estimate of the likely costs and benefits of the drug. Data from a cost-effectiveness study conducted in the US, supplemented by other literature sources, were used to construct a clinical decision tree for likely clinical outcomes for such patients. A panel of UK psychiatrists provided consensus on how these patients would have been managed in the UK. The costs associated with each patient outcome were estimated, and a sensitivity analysis performed to test the assumptions made. For the patients themselves, clozapine would lead to a net gain of 5.87 years of life with no disability or only mild disability. The base case analysis showed that the direct costs of using clozapine were 91 pounds less per annum (or 1333 pounds per lifetime) than for standard neuroleptic therapy, when the effect on all health-care resources was taken into account. In addition, the sensitivity analysis showed that clozapine would be cost-saving or cost-neutral under many different assumptions. A prospective health economic study with clozapine in the
management of schizophrenia would be desirable to confirm these results. (Abstract by: Author)


See Applications of Methodology--Cardiology.


Deep vein thrombosis (DVT) is a common complication in patients undergoing elective hip surgery. Because of the associated risk of pulmonary embolism, prophylaxis with standard (unfractionated) heparin is becoming increasingly important. Recent clinical trials have shown a low molecular weight form of heparin, enoxaparin, to be more effective than standard heparin in preventing DVT, but the new drug is also more expensive. Data on clinical effectiveness and cost were combined in an economic evaluation of the two regimens. It was found that prophylaxis with enoxaparin would be expected to lead to a net saving of 20 pounds per patient. The economic results are sensitive to the costs of enoxaparin, the costs of drug administration and the probability of false clinical diagnosis of DVT or pulmonary embolism. (Abstract by: Author)


This paper assesses the potential for obtaining data on the economic value of antihypertensive medicines and the implications this has for pricing and company research and development strategy.


Increased pressures on health-care budgets mean that governments require good value for money from the resources devoted to health care. In many countries, measures have been introduced to increase efficiency or to contain health-care costs. These include price controls, limitations on reimbursement of health technologies, budgetary reform in health-care institutions, and the encouragement of competition. Given this changing environment, it is important that drugs and other health technologies be shown to give good value for money. The methods of economic evaluation, such as cost-benefit and cost-effectiveness analysis, can be used to assess the value of drugs and other health technologies. They have been widely applied. The economic evaluation of drugs in peripheral vascular disease and stroke would compare the cost of adding the drug with its benefits. These would include improvements in length and quality of life and the savings in treating vascular events that may be postponed, or lessened in intensity, by effective drug therapy. One study, following a clinical trial of naftidrofuryl in stroke, suggested that there would be significant reductions in costs through reductions in hospital stay if recovery was aided. Further research and a large multicenter trial are under way to confirm these findings. In peripheral artery disease there are no economic data collected alongside clinical trials. It is known, however, that the costs of leg ischemia can be significant. A study in the U.K. found that arterial construction would cost around pounds 7,750 per person (1989 prices) and amputation around pounds 11,000 per person. Therefore the costs of drug therapy need to be balanced against the costs of treating progressive disease and the consequent reductions in quality of life for the patient. (Abstract by: Author)

A number of factors may affect the cost effectiveness of treatments and can cause this to vary by location. These factors include the patient population, relative price levels, clinical practice patterns and incentives to health professionals and institutions such as hospitals. This paper illustrates these issues by assessing the relative cost effectiveness of 3 nonsteroidal antiinflammatory drugs (NSAID), with different levels of gastrointestinal side effects, in 3 countries. We conclude that the relative cost effectiveness of drugs is not only dependent on drug price but may also vary by country. (Abstract by: Author)


The introduction of a new antidepressand, venlafaxine, a serotonin norepinephrine reuptake inhibitor (SNRI), has provided researchers with the opportunity to take a closer look at the issues involved in selecting a product for a formulary. To aid decision makers in considering the adoption of this new therapy, a pharmacoeconomic simulation model was developed to evaluate the cost-effectiveness of SNRIs versus traditional oral therapies in the management of patients with major depressive disorders (MDDs) from a cost-based payer perspective. Four treatment regimes for MDD were compared: tricyclic antidepressants, selective serotonin reuptake inhibitors, heterocyclic antidepressants, and SNRIs. The principles of decision analysis were used to calculate outcome probabilities based on data from a meta-analysis. The expected cost of each regimen was calculated using cost data from a survey of three health maintenance organizations located in Missouri, Massachusetts, and California. The model suggests that SNRI therapy demonstrates the highest level of cost effectiveness in an inpatient setting when using both brand and generic acquisition costs of the drugs. When comparing treatment regimens for outpatients, the generic heterocyclic antidepressants demonstrate the highest level of cost-effectiveness; when using brand acquisition costs, the SNRIs demonstrate the highest level of cost-effectiveness. Sensitivity analysis calculated the robustness of the conclusions to all major parameters.


This study used data from a multinational phase III randomized, double-blind, vehicle-controlled trial to evaluate the cost-effectiveness of tirilazad mesylate (Freedox) in the treatment of aneurysmal subarachnoid hemorrhage. In men, therapy with 6 mg/kg per day of tirilazad mesylate was associated with significantly increased survival, increased cost of care, and ratios of cost per death averted that compare favorably with the ratios of other life and death interventions. In women, it appeared to have no effects on costs or survival. Further clinical studies may provide additional information about the cost-effectiveness of this intervention.


Pharmacy benefit management companies (PBMs) have evolved over the past decade in response to the increased demand for health care cost containment. Their activities include the implementation of drug formularies and the negotiation of rebates from manufacturers. Our analysis of this industry is based on interviews and materials provided by the top five ranked PBM companies which account for over 80% of beneficiaries covered within formulary plans. The formularies of these companies are relatively inclusive, but they are becoming more restrictive over time. At present the use of cost-effectiveness (C-E) studies in the formulary
decisions of PBM decisions has been limited. In this regard, the surveyed PBM emphasized that most C-E studies have not compared therapeutic substitutes in populations with characteristics that are similar to those of their clients. Pharmacy benefit management companies also have had strong incentives to focus narrowly on drug costs because they typically manage drug benefits on a "carved-out" basis. However, PBM anticipate a growing future role in the integrated management of patient care (disease management) for certain high cost chronic diseases and conditions. All of the leading firms we surveyed have disease management programs in development. The importance of C-E studies to PBM decisions is expected to increase significantly as disease management programs are implemented. The data infrastructure inherent to the PBM industry and the increasing number of employees with advanced training in pharmacoconomics will permit firms to perform their own internal C-E studies. They are also establishing various alliances and joint ventures with drug manufacturers, health maintenance organizations, and academic institutions to perform these analyses. The leading PBM tend to favor active participation in the development of methodological approaches to C-E studies over government regulations such as those proposed by the FDA in 1995. (Abstract by: Author)


Background: Trials of drug therapy for hypertension have shown that such therapy has a clear overall benefit in preventing cardiovascular disease. Although these trials have included slightly more women than men, it is still not clear whether treatment benefit is similar for both sexes. Objective: To quantify the average treatment effect in both sexes and to determine whether available data show significant differences in treatment effect between women and men. Design: Subgroup meta-analysis of individual patient data according to sex. Results: In women, treatment effect was statistically significant for stroke, (fatal strokes and all strokes) and for major cardiovascular events. In men, it was statistically significant for all categories of events (total and specific mortality, all coronary events, all strokes, and major cardiovascular events). The odds ratios for any category of event did not differ significantly between men and women. In absolute terms, the benefit in women was seen primarily for strokes; in men, treatment prevented as many coronary events as strokes. Graphical analyses suggest that these results could be completely explained by the difference in untreated risk. Conclusions: In terms of relative risk, treatment benefit did not differ between women and men. The absolute risk reduction attributable to treatment seemed to depend on the cardiovascular risk of an individual person in order to rationalize and individualize antihypertensive treatment.


Economic evaluations of pharmaceuticals are increasingly being conducted in conjunction with randomized phase III clinical trials to meet the demand for pharmacoeconomic data when new products are launched. While the need for such data is often global, the trials in which relevant information may be collected are often conducted in only one or a limited number of countries. A critical issue is how data from pivotal clinical trials in one setting can serve as the basis for pharmacoeconomic evaluations in others. We address this issue and report on four economic evaluations that we undertook in conjunction with a recent U.S. phase III clinical trial of recombinant human deoxyribonuclease (rhDNase), which is used to improve pulmonary function in patients with cystic fibrosis (CF). The objective of these evaluations was to estimate the potential impact of rhDNase therapy in France, Germany, Italy, and the United Kingdom on the direct costs of medical care for the treatment of respiratory tract infections (RTIs) in patients with CF. Analyses of economic impact were undertaken both with and without adjustment for
differences in practice patterns between the United States and the countries of interest. Our findings suggest that rhDNase therapy may reduce the cost of RTI-related care by between US$600 and US$1,100 over a 24-week period; the cost of rhDNase is not included in these figures, as a price was unavailable when our analyses were undertaken. Despite methodological challenges, economic evaluations that meet the information needs of decision-makers in diverse countries can nonetheless be undertaken in conjunction with phase III clinical trials. (Abstract by: Author)


An interactive pharmacoeconomic model was designed to evaluate the effects of clinical response and adverse drug events on the comparative cost and cost-effectiveness of a relatively new antibiotic, clarithromycin, compared with those of six other antibiotics used to treat community-acquired lower respiratory tract infection. The cost and cost-effectiveness analyses were based on 12 randomized, double-blind, controlled clinical trials conducted between 1987 and 1992 in regionally distributed outpatient clinics in the US. The trials enrolled a total of 2377 patients. Of the 2377, 1102 were treated for acute exacerbation of chronic bronchitis, 591 for pneumonia, and 201 for either of the two conditions. Safety data for one of the antibiotics was obtained from a trial of patients with sinusitis (N=483). The antibiotics included in this analysis were amoxicillin, cefaclor, cefixime, cefuroxime, ampicillin, clarithromycin, and erythromycin. The main outcome measures were the costs of resources to achieve clinical response to managing adverse drug events, and costs of antibiotic treatment from the perspective of managed care. The mean total cost per episode ranged from nearly $137 to $267. The drug acquisition cost typically contributed a small amount of the overall cost. For the cost-effectiveness analysis, in which complication-free cure was used as a proxy for patient satisfaction, the range of mean cost per complication-free cure varied from $307 for clarithromycin and $612 for cefaclor. When ranked from most to least cost-effective, the order was as follows: clarithromycin, cefexime, amoxicillin, erythromycin, cefuroxime, ampicillin, and cefaclor. The costs associated with clinical management (including treatment failure) and managing adverse drug effects significantly contribute to the total cost and cost-effectiveness of antibiotics in the outpatient setting. Cost-effectiveness analyses are valuable in analyzing the various costs associated with the treatment of lower respiratory tract infection and may be useful tools for physicians managing patients, members of pharmacy and therapeutics committees developing formularies, and medical staff implementing practice guidelines.


The purpose of this study was to investigate empirically the potential cost savings to a pharmaceutical wholesaler using the Economic Order Quantity (EOQ) model. This model allows for calculating the order quantity that minimizes both ordering and holding costs. A regional pharmaceutical wholesaler was selected for a case analysis study using the EOQ model. Eleven brand name products were randomly selected for the analysis. The average yearly cost savings using EOQ was $31.92 per product. The potential yearly cost savings based on 8500 brand name stock-keeping units was $271,320. Using EOQ can therefore assist pharmaceutical wholesalers in minimizing holding and ordering costs and improve efficiency for pharmaceutical distribution channels. (Abstract by: Author)
Case Management


Case management was more cost effective in a moderately uncertain practice environment than in either a low or a high uncertainty environment. The environmental state, case manager role differentiation, and information coordination contributed most strongly to these outcomes.


This article defines case management; identifies differences between first, second, and third generation case management; presents six steps of case management; identifies differences between workers’ compensation case management and medical case management; and introduces case management as a tool the occupational health nurse can use to reduce health care costs associated with health insurance, workers’ compensation, and disability.


Background: Case management has become the statutory basis of community care in the UK for people with long-term mental disorders, although a randomized controlled trial found no important improvements over standard care. Here we compare the costs and cost consequences of this intervention with standard care. Method: Resource-use data were collected over a six-month baseline period and for 14 months after randomization on all patients in the trial. Results: At 14 months the ratio of control group to treatment group weekly costs was 1.09 (95% CI 0.86--1.38) for total costs; 1.12 (0.76--1.65) for state benefits, and 1.21 (0.61-2.42) for health care costs. Costs were thus lower in the treatment group, but these differences were not significant. Conclusions: Retrospective power calculations indicated that the trial could have detected differences of 30% in total costs, but would have required 700 patients per arm to detect a 20% difference in health care costs. Hence this study, which had adequate power to detect clinically meaningful differences, was found to be far too small to detect large differences in costs. Funding agencies increasingly request that clinical trials include economic alongside clinical end-points: these findings may have important lessons for that policy.


CONTEXT: Although experimental studies show that insulin therapy can be safe and efficacious in improving glycemic control in type 2 diabetes under optimal conditions (ie, using patient volunteers with close monitoring under strict study protocols), little is known about its effectiveness, complication rates, and associated resource utilization in actual clinical practice. DESIGN: Cohort study. SETTING: Large staff-model health maintenance organization. PARTICIPANTS: A total of 8668 patients with type 2 diabetes cared for by generalist physicians from 1990 through 1993. OUTCOME MEASURES: Resource use (hospitalizations, outpatient visits, laboratory testing, and home glucose monitoring) and glycemic control were evaluated using combined clinical, survey, and administrative information systems data. Detailed clinical case-mix data, including a newly validated case-mix method, the Total Illness Burden Index, were collected on a sub-sample of 1738 patients. RESULTS: Among patients starting insulin therapy, hemoglobin A1c (HbA1c) decreased by 0.9 percentage point (95% confidence interval, 0.7-1.0) at 1 year compared with those receiving stable medication regimens; however, 2 years...
after starting insulin therapy, 60% still had HbA1c levels of 8% or greater. There was no evidence that some primary care physicians achieved better results than other primary care physicians when starting insulin therapy in their patients. Patients with the poorest baseline glycemic control achieved substantially greater HbA1c reductions; those with a baseline HbA1c level of 13% had a 3-fold greater decline in HbA1c than those whose baseline HbA1c level was 9%. For a subset of all patients for whom detailed clinical case-mix data were obtained, those taking insulin had higher resource use than those taking sulfonylureas, independent of illness severity. After adjusting for age, sex, race, socioeconomic status, disease duration, and severity of diabetes and comorbidities, insulin users had slightly more laboratory tests performed, 2.4 more outpatient visits per year, and almost 300 more fingersticks for home glucose testing per year compared with sulfonylurea users (all P<.01). Although 15% of patients receiving insulin therapy reported weekly symptoms of hypoglycemia, insulin therapy was not associated with an increase in emergency department visits (after case-mix adjustment) and resulted in only 0.5 hypoglycemia-related hospitalizations per 100 patient-years.

CONCLUSIONS: For patients with type 2 diabetes who were cared for by generalist physicians, starting insulin therapy was generally safe and effective in achieving moderate glycemic control in patients who initially had poor glycemic control. However, insulin therapy was associated with increases in resource use and was rarely effective in achieving tight glycemic control, even for those with moderate control. (Abstract by: Author)


Service coordination has long been a documented need of children with disabilities. The purpose of this study was to examine the costs associated with providing a comprehensive system of service coordination for hospitalized infants and toddlers with special health care needs and their families. Coordination costs were evaluated across seven functions including (a) determining eligibility for services, (b) identifying and arranging evaluations, (c) providing support to families, (d) making referrals to outside agencies, (e) exchanging information among service providers and families, (f) maintaining follow-up contact, and (g) determining discharge from the program. Results indicated that the service coordination function of providing family support was the most time-consuming task area, followed by the functions of exchanging information and maintaining follow-up contact. Costs also varied with the medical diagnosis and the child's age. Consistent with this variability, the diagnostic category and/or possibly the length of hospitalization was a better correlate of total cost of service coordination per child than was the number of months served. The complexity of the family’s social and financial situation also appeared to be related to cost per month of service. (Abstract by: Author)


PURPOSE: To examine in 1995 the effects of case management on the context of nursing practice-perceived quality of care delivered, work satisfaction, and control over nursing practice--rather than the commonly studied effect on fiscal outcomes. DESIGN: Prospective quasi-experimental. Sampled were nurses on four units at one community hospital where patients with DRG 107 (Coronary Artery Bypass Graft, with no cardiac catheterization) were traditionally hospitalized. METHODS: Registered nurses on these units completed quality of care, satisfaction, and practice-control scales before and 1 year after implementation. FINDINGS: Significant positive differences were found in several aspects of perceived quality of care for both staff nurses and case managers, with specific increases found in nurses’ perceived ability to develop relationships with patients, ability to be therapeutic, and support for
good care from the institutional structure and administration. A significant decrease in nurses' satisfaction with their pay and other rewards as well as respect from colleagues was found. Case managers were found to have significantly increased perceptions of control over their practice. **CONCLUSIONS:** Case management was found to have a primarily positive effect on nurses-staff and case managers alike. There were significant increases in several aspects of the nurses' perceptions of the quality of care delivered. Additionally, case managers were more satisfied with the administration, the respect they received, and their pay and rewards in the institution. Most strikingly, case managers perceived themselves to have more control over their practice. Some negative effects of the program were a decrease in satisfaction with the pay and rewards by the staff who were not case managers. (Abstract by: Author)


This article identifies the critical characteristics and components of case management, differentiates the case management delivery model from the pharmacy delivery model, describes why case management is an important delivery model in managed care, and discusses the implications of case management for pharmacists.

**Satisfaction and Burnout**


This paper describes a new classification of ward organizational practice in nursing. Data related to aspects of ward nursing practice were collected by postal survey from a nationally representative sample of 74 acute hospital wards, and subjected to hierarchical cluster analysis. The model which was deemed to best 'fit' the data, provided three types of ward practices, which have been named: 'devolved', 'two tier' and 'centralized' nursing. The distinguishing features of the three classifications are similar but not identical to accepted 'ideal types' of primary, team and functional systems. The relationships between wards in each of the three identified categories and other ward organizational practice processes of nursing care and job satisfaction are described. (Abstract by: Author)


This study examined practice patterns of medical laboratory personnel and investigated relationships of job-related variables and job satisfaction for single- and multi-skilled practitioners. Data were collected from a random sample of American Society of Clinical Pathologist-registered practitioners in a five-state region. Twenty-five percent of the sample was categorized as multi-skilled. Regression analysis revealed that work performed had a significant positive contribution to overall job satisfaction for medical laboratory technicians (MLTs) and medical technologists. The strength of the relationship was weakest for multi-skilled MLTs. Results support the contention that when jobs are redesigned, enriching them by adding tasks of increased complexity and challenge is possibly more effective than simply enlarging the jobs with lower- or parallel-level tasks. (Abstract by: Author)


This study assessed the ability of selected intrinsic and extrinsic variables to predict allied health practitioners' work satisfaction in ambulatory care and hospital settings. A total of
413 occupational and physical therapists in Virginia, North Carolina, and South Carolina provided data via a mailed survey. Multiple regression analyses examined the predictive power of selected intrinsic and extrinsic variables upon therapists' work satisfaction in the ambulatory care and hospital setting. The regression model for therapists in ambulatory care settings was a better predictor of work satisfaction than the model for therapists in the hospital setting. Results indicated that respondents' intrinsic orientation toward their work, and their perception of the general working conditions in the organization were two of the strongest predictors of their work satisfaction in the ambulatory care and hospital setting. The findings provide information that can be useful in developing recruitment and retention strategies in both work settings. (Abstract by: Author)


Within 6 months, a 10-member Nursing Services task force created and administered a literature-based retention survey. Tool development and administration is described. The 33-item tool was completed by 85% of the staff. Responses led to the formation of work groups, charged with addressing dissatisfiers and communicating implementation strategies to the hospital at large. (Abstract by: Author)


Job satisfaction of the nursing staff at a 1,000-bed neuropsychiatric veterans administration (VA) facility was assessed, with results similar to those of other studies. The greatest source of stress was nurse/supervisor and nurse/physician interpersonal conflict. This article reports on a further study of this factor. (Abstract by: Author)


We compared the determinants and consequences of burnout for Canadian (N = 586) and Jordanian (N = 263) registered nurses working in a hospital setting. LISREL 7 software was used to perform a path analysis testing hypothesized relationships between job satisfaction dimensions (supervision, hospital identification, kind of work, amount of work, physical work conditions, rewards, and career future) and burnout and intention to quit. For both Canadian and Jordanian nurses, kind of work, amount of work, and career future were important determinants of burnout. Career future and burnout (emotional exhaustion) were associated with intention to quit on the basis of the highly similar results across the two samples, we propose that a universal theoretical model of the determinants and consequences of burnout among nurses may be plausible. (Abstract by: Author)


The purpose of this study was to determine the perceptions of nursing assistants employed in Midwest nursing homes in relation to job satisfaction. The study population included 283 nursing assistants employed in 24 nursing homes. An analysis of frequencies using Chi Square at the .05 level of significance was used to examine the significance of the responses. Study results indicated the nursing assistants were most concerned with the security of their jobs, the potential within their jobs for growth and development, socialization, and challenge in their work. (Abstract by: Author)

This descriptive study examined nurses’ perceptions of their work environment in a Nursing Development Unit (NDU). A postal survey of 70 nurses working in three NDUs was conducted using the Work Environment Scale (WES) for data collection. The response rate was 76%. The aggregate scores from the WES indicate that the nurses surveyed were satisfied with their work environment. The ratings for the 10 subscales of the WES were higher than the norms given by the authors of the scale. However, the findings do not fully support the literature and previous research into nurses’ satisfaction in NDUs. A significant finding of the study was the marked difference, in satisfaction with the work environment, between the three units surveyed. It is suggested that a larger scale study should be carried out to explore whether the findings of this study are reflected in other NDUs. Research into the management of change in NDUs is also suggested. (Abstract by: Author)


ICU nurses who are satisfied with their work are more likely to be retained, leading to institutional cost savings. In this study, higher levels of nurse-physician collaboration in making decisions about patient care were found to be very important to nurses’ satisfaction. (Abstract by: Author)


The purpose of this study was to assess the reproducibility of scores on an instrument designed to measure physical therapy students' burnout. Physical therapy students (28 juniors and 28 seniors) completed an adapted educator's version of the Maslach Burnout Inventory on two occasions within a week interval. At each testing session, a separate score was obtained for each student for the three (emotional exhaustion, depersonalization, and personal accomplishment) subscales of the instrument. These scores, analyzed with a two-factor repeated-measures analysis of variance, indicated a significant difference in the personal accomplishment score between the junior and senior students during the two time frames. Scheffe post hoc tests showed that the junior students reported higher personal accomplishment affect at both testing sessions than the senior students. Both junior and senior students reported higher personal accomplishment at retest than at baseline testing. A test-retest reliability coefficient of .850 was obtained for the Depersonalization subscale; .907 and .715 were obtained for the Emotional Exhaustion and Personal Accomplishment subscales, respectively. (Abstract by: Author)


The first phase of this longitudinal study consisted of a questionnaire completed by a cohort of 1,891 nurses (aged 23-65 years) from six acute care hospitals from the province of Quebec. This study was set up to investigate the association between the psychosocial environment of work and mental health. After adjusting for confounding factors, a combination of high psychological demands and low decision latitude was associated with psychological distress and emotional exhaustion, one of the three dimensions of burnout. Social support at work, although associated with each of the mental health indicators, did not modify their association with job strain. The present study identified conditions of the work environment that are modifiable and provide the basis for interventions that focus beyond the modification of individual coping strategies.

A comprehensive survey of teacher stress, job satisfaction and career commitment among 710 full-time primary school teachers was undertaken by Borg, Riding & Falzon (1991) in the Mediterranean islands of Malta and Gozo. A principal components analysis of a 20-item sources of teacher stress inventory had suggested four distinct dimensions which were labeled: Pupil Misbehavior, Time/Resource Difficulties, Professional Recognition Needs, and Poor Relationships, respectively. To check on the validity of the Borg et al. factor solution, the group of 710 teachers was randomly split into two separate samples. Exploratory factor analysis was carried out on the data from Sample 1 (N = 335), while Sample 2 (N = 375) provided the cross-validation data for a LISREL confirmatory factor analysis. Results supported the proposed dimensionality of the sources of teacher stress (measurement model), along with evidence of an additional teacher stress factor (Workload). Consequently, structural modeling of the 'causal relationships' between the various latent variables and self-reported stress was undertaken on the combined samples (N = 710). Although both non-recursive and recursive models incorporating Poor Colleague Relations as a mediating variable were tested for their goodness-of-fit, a simple regression model provided the most parsimonious fit to the empirical data, wherein Workload and Student Misbehavior accounted for most of the variance in predicting teaching stress. (Abstract by: Author)


Nurse administrators need methods to evaluate and compare staffing across a variety of hospitals because the degree of reengineering that actually has occurred in their communities can be difficult to assess. Multivariate analysis of factors affecting hospital registered nurse (RN) staffing in western New York revealed that the significant factors were the type of unit, nursing model, rural location, and use of aides and unit secretaries. Managed-care factors and alternative uses of staff did not affect RN staffing. Regional market variations may have significant impact on staffing solutions adopted by nurse executives.


Data from a study of 178 managers were analyzed by a sequential decision tree method, which segmented the sample into homogeneous subgroups and gave insight into the relationships between job stress and mental health. Lack of needed information was the first stressor to divide the sample, followed, for the majority of managers, by acceptance by fellow workers, supervisors' evaluations, and conflicting demands.


OBJECTIVES: To identify recent national trends in the employment and earnings of nursing personnel and determine whether managed care is associated with changes in the employment and wage growth of nursing personnel. DESIGN: Retrospective analysis of trends in data on employment and earnings of nursing personnel based on monthly US Bureau of the Census Current Population Surveys between 1983 and 1994, and comparison of trends between states with high and low rates of enrollment in health maintenance organizations (HMOs). POPULATION: Registered nurses (RNs), licensed practical nurses (LPNs), and nurse aides/assistants, orderlies, and attendants (referred to collectively as aides) between the ages of 21 and 64 years. OUTCOME MEASURES: Full- and part-time employment, unemployment, percentage of nursing personnel employed in key sectors of the nurse labor market, and inflation-adjusted hourly wages. RESULTS: From 1983 through 1994, there was strong overall
growth in both RN employment (37%) and inflation-adjusted wages (22%). Beginning in the early 1990s, however, RNs experienced stagnant wages and a small but steady shift toward employment in lower-paying nonhospital settings, particularly in home health care. In states with high HMO enrollment, RN and LPN employment has grown more slowly since 1990, and the shift of RN employment out of the hospital was strongest. For aides and LPNs, the shift out of hospital employment occurred years before that of RNs and at a much greater rate. Since 1990 the employment of aides has grown rapidly in nursing homes and in home health care settings, whereas employment of LPNs has shifted primarily into physician offices and nursing homes. Overall, the movement toward nonhospital employment has had a modest negative impact on wages for all nursing personnel. CONCLUSIONS: Managed care is associated with slower employment growth for RNs in hospitals and a shift toward employment in nonhospital settings, but its effect on earnings has been overshadowed by other forces impacting nurse wages.  (Abstract by: Author)


Little is written about retention and recruitment of nurses in small rural hospitals. The authors present findings of a nursing study that identified factors that encouraged and deterred nurses to practice in the rural environment.  (Abstract by: Author)


A questionnaire developed by the authors was sent to 1000 nurses in various specialty areas. It was used to assess degree of job satisfaction, reasons for dissatisfaction, and the relationships of the work setting and sociodemographic data. Because the authors wanted to compare nurses who work primarily with older adults within and outside long-term care, the percentage of time spent caring for patients aged over 60 was also studied. The degree of job satisfaction between nurses working in long-term care was compared. A comparison of job satisfaction was also made between nurses working at least 75% of the time with older adults and nurses not working primarily with older adults. Factors causing job dissatisfaction in the long-term care group and the non-long-term care group were identified. Strategies to increase job satisfaction in long-term care were presented.  (Abstract by: Author)


Job satisfaction remains an important consideration for both employer and employee and, despite numerous investigations, many questions about it remain unanswered. Many research methodologies have been used with varying degrees of success. However, the trend is now away from simple correlational studies towards modeling techniques. Data from 221 female nurses working full-time in hospitals were collected using questionnaires delivered with monthly salary cheques. The model presented had many statistically significant path coefficients including (in order of size): benefits, participation in decision making, education, routine, promotion, and opportunity for advancement outside their institution. The level of salary was not found to be a statistically significant factor in determining job satisfaction.  (Abstract by: Author)


Nursing staff turnover remains a financial concern to public as well as private institutions, and it has an impact on staff morale and working practices. Evidence suggests that staff turnover could also have a detrimental effect on patient care. Numerous studies have examined
the reasons why staff leave their jobs, but these have often produced conflicting findings and have frequently relied upon bivariate correlation or multiple regression techniques. The availability of analytical techniques such as structural modeling provides an opportunity to examine several aspects of turnover behavior simultaneously, and overcome some of the methodological difficulties encountered by prior research. This study involved 221 female nurses working full-time in hospitals to examine aspects of the nursing turnover model. Using modeling techniques, this current study found job satisfaction and participation at work to be important variables in the turnover process. This is in keeping with other models of nursing turnover. (Abstract by: Author)


A study of nursing staff on two units of a long-term nursing facility examined their reasons for enjoying and disliking their jobs, and daily reports of positive and negative events experienced along with their rating of the emotional intensity of those events. Each of the 30 members of the nursing staff responded to a brief demographic questionnaire. The nursing staff expressed strong positive attitudes towards their jobs. They described a wide range of concerns, both positive and negative, relating to institutional, unit management, and direct patient care issues. The mean intensities associated with positive and negative events at each of the areas of concern were above 7.5 on a 10-point scale (10 = highest intensity), with the exception of the intensity of negative events at the patient level (mean = 6.2). The intensity for positive events at the patient level was among the highest (mean = 9.2). The difference between the two means at the patient level suggests that nursing staff have adjusted to their work by focusing on positive patient events and by tempering their reaction to negative patient events. (Abstract by: Author)


Previous investigators have identified residential differences in the job satisfaction of hospital nurses. However, the degree to which the greater job satisfaction of rural nurses can be generalized beyond hospitals to other work settings, including nursing homes, is unknown. The purpose of this research was to examine the job satisfaction of nurses (registered and licensed practical) employed in both rural and urban nursing homes. A total of 281 nurses from 26 participating nursing homes completed a mailed questionnaire that measured the personal and job-specific characteristics of the nurses and the contextual properties of the facilities in which they worked. The data indicated no statistically significant differences in the overall job satisfaction, or on any of the five subscales of the instrument, between rural and urban nurses. However, a pooled multivariate model identified five factors that predicted the job satisfaction of nurses employed in long-term care facilities: the employees’ race and personal income; the employees’ perception that their supervisor was interested in their career aspirations; the length of time that the nurses had intended to stay at the time of their hiring; and their current intent to leave. (Abstract by: Author)


OBJECTIVE: This study examined the relationship of the organizational variables of structure, technology, and environment with job satisfaction among public health nurses in a southeastern state. BACKGROUND: There is little research on the characteristics of the work environment that influence nurses to remain in the public health work setting. Prior research in this setting has focused on the negative aspects of the nursing positions. These aspects of
least desirability for the public health nurse provide only a partial view of job satisfaction. To
decide and plan specific strategies, the nurse administrator must have valid and useful
information about the positive aspects of job satisfaction of public health nurses. METHODS:
The researchers distributed a questionnaire to all licensed nursing personnel employed by a
state public health department. Data collection consisted of four tools: 1) structure instrument;
2) technology instrument; 3) environmental uncertainty instrument; and 4) McCloskey-Mueller
Job Satisfaction Scale (MMSS). The sample of 838 public health nurses (response rate of
50.6%) included representation from all 13 districts and the central office of the public health
department. RESULTS: Significant relationships were found between job satisfaction and the
demographic variables of nurse category (registered nurse and licensed practical nurse) and
years of experience with the public health department. The critical variable for predicting job
satisfaction in this group of public health nurses was organizational structure (vertical
participation, horizontal participation, and formalization). Dimensions of structure accounted for
41% of the variance in job satisfaction. Structure remained the critical predictor of job
satisfaction, although the findings do not suggest a conclusive model. The three dimensions of
technology (instability, variability, and uncertainty) and environmental uncertainty assumed
significance only in concert with each other or with the dimensions of structure.
CONCLUSIONS: This study contributes to nursing management theory by examining the
relationship of organizational structure, technology, and environmental uncertainty with job
satisfaction in public health nurses. This research also has implications for nurse administrators
in public health for creating more flexible work environments and facilitating staff involvement in
decision making.


The antecedents and outcomes of feelings of job-related stress and personal
achievement were studied in a large sample of consultant doctors working in Scotland. In a
sample of 333 doctors it was found that a tendency to use emotion-oriented coping strategies
and negative appraisals of organizational changes in the practice of medicine mediated the
effect of the personality dimension of Neuroticism on reported job stress. Job stress levels
predicted the degree of 'burnout' experienced by doctors, i.e. their tendencies to be emotionally
exhausted by their work and to dehumanize patients. Higher clinical workloads were related to
higher levels of stress but also to higher feelings of personal achievement. A substantial
proportion of the variance in many of the variables in the stress model was accounted for by a
general tendency to experience negative emotions, closely related to Neuroticism; this general
factor appeared to be similar to the recently formulated concepts of 'negative affectivity' and
'somatopsychic distress'. The personality factors of Extraversion and Conscientiousness both
contributed to positive feelings of personal achievement (N = 344); the effect of Extraversion
was direct, whereas the effect of Conscientiousness was mediated by a tendency to use task-
oriented coping strategies. Models of the processes of stress and personal achievement were
tested for acceptability using the EQS Structural Equations Program. The implications of the
models for transactional theories of stress are discussed. (Abstract by: Author)


To facilitate nurses' job satisfaction and reduce their psychological distress, it is useful
for a nursing manager to know whether factors within the workplace provide greater prediction
of these affective states than variables outside the domain of work, and whether there are
common predictors of satisfaction and distress. The relative importance of occupational and
nonoccupational variables in the prediction of job satisfaction and psychological distress was
investigated in a survey of hospital nurses (N = 376). Perceived relations with the head nurse,
coworkers, physicians, and other units/departments, along with unit tenure and job/nonjob conflict, were predictors of job satisfaction. Personal disposition (anxiety-trait), social integration, unit tenure, professional experience, position level, and job/nonjob conflict, along with the relations with the head nurse and physicians, were predictors of psychological distress. The relations with the head nurse and physicians, as well as unit tenure and job/nonjob conflict, were predictors of both satisfaction and distress. The prediction by unit tenure is noteworthy. Unit tenure had a negative relationship to satisfaction and a positive one to distress, whereas total experience had a negative relationship to psychological distress and none with job satisfaction. The role of unit tenure in nurses' affective experiences warrants more attention in future research, along with the role of job/nonjob conflict and other variables predictive of nurses' satisfaction and distress. (Abstract by: Author)


To evaluate physiatrist career satisfaction and current practice patterns, a 15-page survey was mailed randomly to 400 fellow members of the American Academy of Physical Medicine and Rehabilitation. The 208 questionnaires (52%) returned revealed respondents' level of satisfaction with career choice, current practice, relationships with other physicians, their own residency training, and problems experienced that impede their practice. Factor analysis identified six areas of satisfaction: time demands, organizational support, current practice, current specialty, profession, and training. Problems with work consisted of four factors: external intrusions into practice, having to deal with non-rehabilitation problems, dealing with PM&R problems, and insufficient time for patients. Results showed that 75% of physiatrists were satisfied with their practice/profession. Satisfaction with current practice was greater with fewer external intrusions into practice, a larger percentage of income from traditional non-managed payment sources (including Medicaid), and less competition. Changes in health care, such as managed care, competition, and increased external regulations, appear to interfere with current practice. Variation in satisfaction was not significantly correlated with size of community, variation in rates of payment denials, workloads of greater than 50 hours per week, and a number of other factors that one might expect to affect satisfaction. Physiatrists had made many changes in their practice in response to the changes in the health care environment but had not cut care for indigent patients. Needs for greater residency training in outpatient clinics, physicians' offices, managed care, and long-term care settings were expressed. This is the first comprehensive published report on physiatric satisfaction in a changing health care environment. Further research in some of the areas will be required. (Abstract by: Author)


OBJECTIVES: To determine the prevalence of, and factors associated with, burnout among pediatric intensivists across a variety of practice settings. DESIGN: A population-based survey, using a mailed questionnaire that included a previously validated Burnout Scale. SETTING: Private and academic pediatric critical care practices. PARTICIPANTS: Respondents from among all members of the Pediatric Section of the Society of Critical Care Medicine and all physicians certified in pediatric critical care medicine by the American Board of Pediatrics. MEASUREMENTS AND MAIN RESULTS: The questionnaire consisted of demographic items, variables noted in the literature as being associated with burnout (e.g., the individual's perception of how others valued their work, and the use of preventive measures such as regular exercise to relieve stress), and a validated Burnout Scale. The questionnaire also included questions pertaining to past training, practice of other primary specialties or subspecialties, practice settings, admission responsibilities, actual and preferred practice activities, total work effort, academic activities, and causes of stress at work. The Burnout Scale
of Pines and Aronson is a self-diagnosis instrument, consisting of 21 questions using a 7-point frequency scale. The total Burnout Score represents an average of the scores for the individual components. Scores of < or = 3 in our study were classified as "not burned out." Scores of > 3 and < or = 4 were classified as "at risk." Scores of > 4 were classified as "burned out." A total of 883 questionnaires were mailed; 474 (56%) were respondent returns and 35 questionnaires could not be delivered. Primary analyses focused on the 389 respondent attending physicians presently practicing pediatric critical care medicine at the time of the survey. The average Burnout Score of these attending physicians was 3.1 +/- 0.8; 36% were classified as being at risk for burnout, and 14% were classified as burned out. There was no association between burnout status and the following work conditions: having fellows; having protected time for research and publications; frequency of being called at home; frequency of returning to the hospital when called at home; or call schedule. Respondents classified as burned out were significantly more likely than respondents who were classified as not burned out to feel that their work was not valued by others. Burned out respondents were less likely than respondents who were not burned out to give the following description: feeling very successful; feeling that their peers viewed them as very successful; feeling satisfied in their professional life; and routinely exercising or having some other outside interest. CONCLUSIONS: We found that a high degree of burnout exists in pediatric critical care medicine, with 50% of pediatric intensivists at risk or burned out. Overall, there was no association between Burnout Scores and training, practice specialties, or practice settings, nor was there an association with aspects of practice that are physically taxing. However, perceptions about the value of their work and feelings of success and satisfaction were highly associated with those respondents classified as burned out. Routine exercise (a strategy used by some for stress reduction) was associated with lower Burnout Scores. Further studies are necessary to evaluate the trends that we have reported and to identify causal factors. (Abstract by: Author)


We know from numerous industrial studies that stress, particularly in the form of tiredness and sleep deprivation, has a detrimental effect upon work performance, though this is not so clear-cut in studies of doctors, despite their stress levels being particularly high. This study explores the doctors' views on this using anonymous questionnaires from a population of 225 hospital doctors and general practitioners, 82 of whom reported recent incidents where they considered that symptoms of stress had negatively affected their patient care. The qualitative accounts they gave were coded for the attribution (type of stress symptom) made, and the effect it had. Half of these effects concerned lowered standards of care; 40% were the expression of irritability or anger; 7% were serious mistakes which still avoided directly leading to death; and two resulted in patient death. The attributions given for these were largely to do with tiredness (57%) and the pressure of overwork (28%), followed by depression or anxiety (8%), and the effects of alcohol (5%). The data are discussed in terms of the links made by the doctors between their fatigue or work pressure and the way they care for patients. It presumes that these incidents had been previously unreported and talks about the effects this secrecy has on the emotional state of the doctors concerned. It offers ways forward for tackling the problem, of interest to the profession, managers and commissioners. (Abstract by: Author)


Nurse managers control quality and cost of the principal service provided by long-term care agencies. Job satisfaction was higher for long-term care nurse managers in metropolitan than in rural or suburban agencies. Findings suggest that continuing education may increase task satisfaction, as well as job knowledge of diploma-prepared nurse managers.

Although the benefits of satisfying nurses in their jobs often are assumed, there is limited research evidence to support such assumptions. Administrators, basing their actions in job satisfaction theory, find that the anticipated benefits of satisfying nurses are not always realized. Changes intended to improve job satisfaction may be costly. The authors review the research and theoretical evidence for effects of job satisfaction on turnover, quality of care, and patient satisfaction and report the findings of a recent study of nurses’ job satisfaction, quality of care, and patient satisfaction. Implications for nurse administrators who use job satisfaction as a management tool are discussed. (Abstract by: Author)


Using multiple regression analysis, this study examined the contribution of demographic, job-related, social-support, and caregiving variables to the prediction of work-family conflict, stress, and job satisfaction among a sample of 101 hospital-based nurses who had responsibility for the care of a child and/or an elderly relative. The results revealed that family support, perceived organizational support for family life, perceived workload size, and involvement in child care were mainly responsible for the outcomes studied. In addition, the study underscores the importance of separately measuring both the source and the direction of work-family conflict. (Abstract by: Author)


This article considers the results of an opinion survey of nurses working in Gwynedd, North Wales. Present changes to the structure and function of the NHS are heightening concerns and eroding the strengths of the profession. Action is needed if nursing’s move towards enhanced professional status is to be maintained. (Abstract by: Author)


This study examines the relationship between middle nurse managers' (MNMs) job satisfaction and how they perceive their chief nurse executive's (CNE) leadership style and adaptability. The CNE's own leadership style and adaptability were studied. The study thus examined the interplay between job satisfaction (specifically satisfaction with supervision), leadership style and leadership adaptability. (Abstract by: Author)


OBJECTIVES: Caring for acutely ill patients imposes significant demands on physicians. The environment and stresses of the ICU may lead to the burnout syndrome. The purpose of this study was to evaluate the prevalence of burnout among internal medicine intensivists and the contributing factors present in ICU practice. DESIGN: Mailed survey utilizing the Maslach Burnout Inventory (MBI). Increasing burnout has been shown to be associated with low levels on personal achievement and high scores on depersonalization and emotional exhaustion. SUBJECTS: Random sample of members of the Internal Medicine Section of the Society of Critical Care Medicine. MEASUREMENTS AND MAIN RESULTS: 248 people responded: 220 (88.7%) males and 28 females. Mean age of all respondents was 41.6 +/- 6.7 years. The majority (58.1%) worked in large hospitals (> 400 beds); 55.6% devoted more than 50% of their time to critical care. The emotional exhaustion subscale of the MBI averaged 22.2 +/- 9.5, with a third of respondents scoring in the high range. The depersonalization score averaged 7.1 +/---
5.1%, with 20.4% of respondents scoring in the high range. Similarly personal achievement subscores were poor, with a mean value of 30.9 +/- 6.4%, with 59% scoring in the low range. High levels of emotional exhaustion were associated with anticipating leaving critical care before retirement. CONCLUSIONS: Burnout as measured by the MBI appears to be common in internal medicine intensivists. High levels of emotional exhaustion and depersonalization are related not only to patient care issues but also to a poor support system. (Abstract by: Author)


CONTEXT: Nearly all managed care plans rely on a physician “gatekeeper” to control use of specialty, hospital, and other expensive services. Gatekeeping is intended to reduce costs while maintaining or improving quality of care by increasing coordination and prevention and reducing duplicative or inappropriate care. Whether gatekeeping achieves these goals remains largely unproven. OBJECTIVE: To assess physicians' attitudes about the effects of gatekeeping compared with traditional care on administrative work, quality of patient care, appropriateness of resource use, and cost. DESIGN: Cross-sectional survey of primary care physicians SETTING: Outpatient facilities in metropolitan Boston, Mass. PARTICIPANTS: All physicians who served as both primary care gatekeepers and traditional Blue Cross/Blue Shield providers for the employees of Massachusetts General Hospital, Boston. Of the 330 physicians surveyed, 202 (61%) responded. OUTCOMES MEASURES: Physician ratings of the effects of gatekeeping on 21 aspects of care, including administrative work, physician-patient interactions, decision making, appropriateness of resource use, cost, and quality of care. RESULTS: Physicians reported that gatekeeping (compared with traditional care) had a positive effect on control of costs, frequency, and appropriateness of preventive services and knowledge of a patient's overall care (P<.001). They also felt that gatekeeping increased paperwork and telephone calls and negatively affected the overall quality of care, access to specialists, ability to order expensive tests and procedures, freedom in clinical decisions, time spent with patients, physician-patient relationships, and appropriate use of hospitalizations and laboratory tests (P<.001). Overall, 32% of physicians rated gatekeeping as better than traditional care, 40% the same, 21% gatekeeping as worse, and 7% were of mixed opinion. Positive ratings of gatekeeping were associated with fewer years in clinical practice, generalist training, and experience with gatekeeping and health maintenance organization plans. CONCLUSIONS: Physicians identified both positive and negative effects of gatekeeping. Overall, 72% of physicians thought gatekeeping was better than or comparable to traditional care arrangements.


This article describes a cross-sectional study that examined the effect of students' pre-enrollment perceptions of nursing education on attrition. It was hypothesized that more students who leave (leavers) than students who continue would report a discrepancy between these perceptions and their nursing academic experience. It was also hypothesized that leavers would rate several potential stressors as more important concerning decisions to leave than would continuers. The sample comprised students who commenced their nursing education at an Australian tertiary institution. As predicted, a greater percentage of leavers than continuers reported nursing content to differ from what they expected. The major area of conflict was the scientific component in nursing knowledge. The groups did not differ concerning potential stressors' influence on decisions to leave. While constrained by its cross-sectional nature, this study's findings suggest a need to adequately convey the scientific basis of nursing knowledge to potential students and to deal with misconceptions early in education, to reduce attrition. (Abstract by: Author)

Objectives: A randomized controlled trial; evaluated the impact of feedback and financial incentives on physician compliance with cancer screening guidelines for women 50 years of age and older in a Medicaid HMO. Methods: Half of 52 primary care sites received the intervention, which included written feedback and a financial bonus. Mammography, breast exam, colorectal rates were evaluated. Results: From 1993 to 1995, screening rates doubled overall (from 24% to 50%), with no significant differences between intervention and control group sites. Conclusions: Financial incentives and feedback did improve physician compliance with cancer screening guidelines in a Medicaid HMO.


Burnout is an increasingly important problem in modern work organizations. Few studies, however, have explicitly applied an adequate theoretical understanding of the performance of modern organizations. This article aims to initiate both a discussion of this phenomenon and higher-quality research into the emergence of burnout based on an understanding of the economic-technological rationalization and control (management control) of production and service processes. In applying production control, both technical and bureaucratic, group and attitudinal control systems are increasingly integrated. This so-called systematic control strategy is one of the major causes of burnout. The cumulative effect of an increasing workload combined with reduced resources due to economic considerations and technocratic implementation of production control is assumed to be relevant to the development of burnout. The authors' propositions apply to service workers in human service organizations and to key workers in enterprises using flexible specialization combined with self-directed work groups. (Abstract by: Author)


The aim of this study was to investigate the relationship between the development of burnout in the nursing staff and traits of personality, as well as sociodemographic and professional characteristics. Maslach Burnout Inventory and Eysenck Personality Questionnaire were used to evaluate all the members of the nursing staff of General Hospital AHEPA. Data on sociodemographic and professional characteristics of the staff were gathered as well. The analysis showed that there is a complex interaction of the measured characteristics of the sample that leads to the development of burnout. The model of burnout development is not only nonlinear, that is, different variables play a different role in each level of burnout development, but also points to a discontinuity between 'normal' attitude towards work and true burnout. This suggests the possibility that burnout is a true clinical syndrome with neurotic features rather than a magnification of normal tiredness from work. (Abstract by: Author)


A meta-analytic study investigated the causal relationships among job satisfaction, behavioral intentions, and nurse turnover behavior. A theoretical model was proposed in which behavioral intentions were viewed as a direct antecedent to turnover behavior. Job satisfaction was expected to be indirectly related to turnover by virtue of the mediating role of behavioral intentions. Consistent with these expectations, a strong positive relationship was indicated between behavioral intentions and turnover; a strong negative relationship between job satisfaction and behavioral intentions; and a small negative relationship between job satisfaction
and turnover. The results of the modifier analysis suggested that effect sizes are fairly robust to differences in study designs, response rates, and methods of measuring job satisfaction, but the manner in which behavioral intentions were operationalized appeared to moderate the relationship between behavioral intentions and turnover and job satisfaction. Of variables related to nursing job satisfaction, work content and work environment had a stronger relationship with job satisfaction than economic or individual difference variables. (Abstract by: Author)


The aim of this article is to describe job satisfaction and burnout among two categories of community-based nurses (N = 402) in the Netherlands taking account of job and individual characteristics. Results show that these nurses are moderately satisfied with their jobs and the effects of burnout are average. Further, community nurses are less satisfied and have experienced burnout to a greater extent than community nurse auxiliaries. Both job characteristics and individual characteristics are related to job satisfaction and burnout. However, job satisfaction is affected to a greater extent by job characteristics whereas burnout is more often a result of individual characteristics. As research in this area is scarce and home care is changing radically, these results may be valuable in coping with change without losing sight of nursing’s professional values. (Abstract by: Author)


This study examines the relationship between the psychosocial work environment and cross-sectional job dissatisfaction and prospective psychiatric distress in a cohort of Hopkins Medical School graduates in mid-career. An instrument was constructed consisting of five scales: psychological job demands, patient demands, work control, physician resources, and coworker support. The results of scale reliability and factor analysis are presented. Higher job demands were found to be associated with increases in job dissatisfaction and psychiatric distress and greater resources were associated with decreased levels of dissatisfaction and distress. In multiple-regression analysis, only work control and social support were found to be independently associated with dissatisfaction and distress. These results suggest that the presence of control and social support at work protects physicians from developing job dissatisfaction and psychiatric distress.


Job satisfaction for registered nurses continues to be a source of conflict and dissension within the health care delivery system. The acute shortage of registered nurses in previous decades has abated, but turnover has not. Reengineering, restructuring, and other new care delivery organizational patterns are being implemented as cost savings are sought. A cross-sectional descriptive survey of a nursing organization was conducted on the eve of implementation of a change in the care pattern at a large, acute care institution. Although results indicated a low level of job satisfaction overall, the nurses indicated that there was respect and value for nursing within the institution. (Abstract by: Author)


Based on Vroom's expectancy theory, this study was conducted to identify differences in job satisfaction between nurses working in public health settings, and staff nurses and
administrators working in both settings. Questionnaires containing an adaptation of a job satisfaction scale were mailed to all 258 registered nurses practicing in public health and home health settings (response rate 57%) in a rural Midwestern state. Respondents were asked to rate their satisfaction with various dimensions of their jobs, as well as how important each aspect was to them. Although both groups of nurses reported low satisfaction with salary, public health nurses were significantly less satisfied with their salaries than were home health nurses (F = 32.96, P < or = 0.001); home health nurses, however, were significantly less satisfied with benefits/rewards (F = 11.85, P < or = 0.001), task requirements (F = 8.37, P < or = 0.05), and professional status (F = 5.30, P < or = 0.05). Although administrators did not differ significantly from staff nurses on job satisfaction, they did perceive organizational climate (F = 4.50, P < or = 0.05) to be an important feature of satisfaction. These differences may be partially explained by divergent salaries, roles, and responsibilities between public health and home health nurses. (Abstract by: Author)


To enable registered nurses to devote more time to planning and coordinating care, a hospital-wide program was implemented to improve nursing assistant use and productivity. After implementation of the program, registered nurses noticed a decreased work load, improved quality of nursing care, and increased ability to supervise assistants. In addition, trended data suggest improved quality of nursing care and patients satisfaction. (Abstract by: Author)


Eighty social workers working with elderly patients in 36 acute care hospitals provided information about their overall job satisfaction as discharge planners and identified sources of satisfaction and dissatisfaction in their jobs. Twenty-eight percent were very satisfied and 50 percent somewhat satisfied with their jobs. Sources of satisfaction were the ability to help patients and families, concrete resource provision, job challenge, and autonomy. Dissatisfaction resulted from organizational constraints and lack of support from other health care professionals. Educational and theoretical implications are discussed.


The following organizational elements lead to greater job satisfaction for direct care staff: 1) the promotion of appropriate and respectful administration; 2) consistent organizational structures; 3) a teamwork philosophy; 4) focusing on the person rather than the bed and body work; and 5) a homelike environment. Direct care staff feel that regular visitation is key to family members being actively involved in the resident's care. Staff view family members as essential in providing a sense of historical self of the resident, which in turn provides support for direct care staff in relating to residents as persons.


OBJECTIVE: To examine the 1996 outcomes of a sample of Western Australian rural doctors who in 1986 had indicated their intentions to stay in or leave rural practice. DESIGN: Postal questionnaire survey in December 1996, semi-structured interview and feedback by doctors on a draft of this article. PARTICIPANTS: 91 respondents from the 101 doctors who in 1986 had filled in a questionnaire on their intentions to stay in or leave rural practice. MAIN OUTCOME MEASURES: Proportion of doctors whose actions by 1996 were at variance with
their intentions in 1986, and the reasons for their change of direction. RESULTS: 49% (22/45) of doctors who intended to leave had stayed ("stayers") and 24% (11/46) who intended to stay had left ("leavers"). Doctors' main concerns in 1986 were overwork, lack of locum relief, professional contact with colleagues, specialist backup in emergencies, downsizing of hospital facilities, continuing medical education, and income. By 1996 stayers had solved most of these professional problems and felt they were doing a special job which made a difference to their community. Conversely, more than half the leavers were unable to solve these problems and felt disempowered and dispirited. Their most potentially solvable problems were overwork, forced de-skilling and conflict with other healthcare professionals. CONCLUSION: Professional satisfaction was the main reason for doctors staying in or leaving rural practice. Professionally dissatisfied rural doctors reach a critical phase, which they have to surmount if they are going to stay. An examination of the positive experiences of the stayers points the way to retaining at least half the potential future leavers.


Burnout in social services professionals has been defined as a syndrome of emotional exhaustion, depersonalization, and reduced personal accomplishment. The pediatric critical care nurse is especially vulnerable to this phenomenon when exposed to prolonged, chronic suffering of a patient. The rewarding aspect of caring for the critically ill child who recovers from significant affliction is not experienced when caring for the "chronic child." This article reviews the dynamics of chronicity in pediatric critical care and explores protective strategies for burnout management. Several of Jean Watson's carative factors that define her human care philosophy provide the conceptual framework for the approaches outlined. (Abstract by: Author)


Mother Teresa once said, "To keep the lamp burning, we have to keep putting oil in it." Here are suggestions about how to keep the flame of nursing burning brightly in your life.


BACKGROUND. Recent changes in the general practitioner contract have produced increased workload and stress, poorer mental health and reduced job satisfaction. These factors might combine to increase the level of 'burnout' among general practitioners. AIM. This study set out to examine the extent of burnout among general practitioners. METHOD. A questionnaire was sent to all 295 Northamptonshire general practitioners seeking demographic details and including the Maslach burnout inventory. The results for the inventory were compared with the results from a sample of physicians and nurses in North America. RESULTS. There was a significantly higher level of burnout among the Northamptonshire doctors compared with the North American sample. There was virtually no association between age and the level of burnout, although a small negative correlation was found between age and the depersonalization of others subscale. Part-time general practitioners showed lower levels of burnout than full-time general practitioners. CONCLUSION. This study highlights the need to look both at the extent of burnout in young doctors during their training and at those characteristics of part-time general practitioners which might prevent burnout. (Abstract by: Author)

One concern of healthcare professionals today is the high turnover rate of hospital nursing staff. This article discusses role efficacy and its relation to job satisfaction of hospital nurses. It describes a role-efficacy model and analyzes nurses' perceptions of feedback from the job itself, nursing supervisors, physicians, and hospital administrators. The impact of role efficacy and job satisfaction on improved recruitment and retention of nurses and the role of staff development in the improvement process is explained. (Abstract by: Author)


OBJECTIVE: To examine the extra burden placed on consultant physicians when providing cross cover for colleagues who are absent on annual or study leave. METHODS: A questionnaire was sent to 455 consultant physicians with an interest in gastroenterology, practising in the UK in October 1996. RESULTS: The response rate was 77%, with 350 completed forms returned. Ninety percent of respondents participate in the acute intake; they provide 85% of cross cover for their colleagues. Only 2% of this burden is carried by the appointment of locums. CONCLUSION: Provision of satisfactory cover for inpatients under the care of absent colleagues can place serious demands on consultants at a time when their specialty commitments are also high. Future manpower planning must take these added burdens into consideration. (Abstract by: Author)


A process model proposing that over involvement affects job satisfaction exclusively through its impact on worker burnout was tested. The model was supported strongly in both a current sample of social workers and an earlier study of helping professionals. Methodological limitations are discussed and implications for practice are examined. (Abstract by: Author)


A nationwide study on the impact of shared values on staff nurse job satisfaction and perceived productivity was done in 24 hospitals under different auspices, some of which were also Magnet Hospitals. Data were obtained from a 25% random sample of the staff nurse population (N = 2,336), 58% of the head nurse group, 65% of the clinical experts, and 66% of the top management. Staff nurses and clinical experts had more value congruence than did staff nurses and head nurses. A significant inverse correlation was found between value congruence and nurse job satisfaction and quality care. Explanations of the finding center on recent role changes for both staff nurses and head nurses, power differential, and evolving clarity of the staff nurse role. A serendipitous finding was that staff nurses reported fewer factors as important to their job satisfaction and perceived environment conducive to quality patient care than did other members of the nursing department. However, factors important to staff nurses were very important. (Abstract by: Author)


Nurse administrators are seeking ways to create organizational work environments that empower nurses to exercise more control over the content and context of their practice. This study used Rosabeth Kanter's Structural Theory of Organizational Behavior to examine relationships between staff nurses' perceptions of work empowerment, and control over nursing
practice, and subsequently, job satisfaction and perceived work effectiveness. Implications for nurse administrators are discussed. (Abstract by: Author)


Replication of the Anticipated Turnover Model Among Nurses for urban registered nurses provided substantial support for the stability and generalizability of the theoretical model. In both the original and replication studies, causal modeling was used to test the theoretical model predicting job satisfaction, anticipated turnover, and actual turnover. The replication study included 385 full-time nurses in two public and two private urban hospitals. The replication validated, with younger, more educated staff, the major findings from the original study. Group cohesion and job satisfaction effectively predicted anticipated turnover in the replication and the original study. Anticipated turnover was a good predictor of actual turnover, with discriminant analysis yielding 73.2% successful predictions in the replication study and 76.2% in the original study. Job satisfaction effectively buffered job stress. The replication also substantiated the position that job satisfaction strategies need to be targeted specifically to the types of clinical services. (28 ref)


See Applications of Methodology—Case Management.

This study attempted to address the problem of stress and burnout in hospital nurses by exploring factors which affect job satisfaction and the relationship between these and absence rates. Fifty nurses working in the elderly care unit of a district general hospital were asked to complete a job satisfaction questionnaire, specifically developed to include factors appropriate to the study, together with Maslach's burnout inventory and Beck's hopelessness scale. The hypothesis that job satisfaction is related to absenteeism was not supported. However, significant correlations between some variables were isolated. These correlations were tested using Spearman's risk correlation coefficient. It is hoped that the job satisfaction questionnaire will become a useful instrument in screening those at risk of burnout, and a diagnostic aid to help consider the factors which affect job satisfaction. The implications of the study point to the need for the prevention of stress from environmental factors by the adoption of organizational strategies to promote positive working conditions, and the development of coping strategies in the form of stress awareness seminars, regular staff support groups and counseling services. (Abstract by: Author)


In this 2-year follow-up of 100 nurses, significant increases were observed for burnout and depressive symptomatology. Analysis of change scores and structural equations suggested that the variance shared by burnout and depression (20%) may be attributable to their co-development. A definitive temporal sequence among measures of burnout and depressive affect was not obtained. At initial assessment and follow-up, burned-out nurses displayed accurate perceptions of job uncontrollability, whereas non-burned-out nurses overestimated job control. Perceptual accuracy increased in linear fashion with degree of burnout, irrespective of depressive symptomatology. Frequency of threats to job control predicted a significant amount of the variance in perceptual accuracy, supporting the view that "burnout realism" is reality driven. (Abstract by: Author)


When healthcare managers use certain leadership behaviors, does it really make a difference in employee outcomes? Is there an impact on job satisfaction, productivity, and organizational commitment? The author compares the findings in two research studies conducted in different hospital settings. She then describes practical application of the findings for the nursing administrator. (Abstract by: Author)


How do managers influence their nurses job satisfaction, productivity, and commitment to the organization? The author discusses the findings of her study drawing comparisons to other studies and suggesting implications for improving managerial supervision, organizational performance and outcomes. (Abstract by: Author)


As managed care has disseminated throughout our health system, physicians have increasingly assumed the status of employees. The pressures associated with this cultural change and the changes in medical practice style and pattern required by managed care employers, could result in a significant increase in the number of physicians experiencing
burnout. This in turn could lead to a decrease in the quality and efficiency of the health care delivered by such organizations. In view of this, physician employers should become more aware of the problem and take appropriate preventive measures. (Abstract by: Author)


The purpose of this study was to determine if a relationship exists between work roles, work role values and job satisfaction for registered nurses employed in the hospital setting in the USA. A total of 201 nurses responded (33% response rate) to a survey instrument consisting of questions regarding work roles, work role values and the Minnesota Satisfaction Questionnaire. Spearman’s rank order and Pearson’s product moment tests were carried out to determine the correlation between the three factors. Although the resulting information was not statistically significant (r = 0.12), the strength of this study lies in its conceptual and theoretical bases. (Abstract by: Author)


Faculty dissatisfaction and fewer qualified recruits choosing a career in academia threaten the integrity of the higher education system. Retention of highly qualified nurse faculty affects the reputation of the school of nursing, the faculty commitment to the organization, and the learning environment for students. Through use of a system's framework derived from Neuman and Kast and Rosenzweig, the purpose of this survey was to ascertain the relationship between job satisfaction among nurse faculty and selected demographic variables, organizational characteristics, and role orientation. Approximately 80 per cent of the schools of nursing in the target population of universities offering a doctorate in nursing participated in the study. The overall subject response rate was 60 per cent. Instruments used for data collection included three researcher-developed tools and two standardized instruments to measure job satisfaction (the Job Descriptive Index and the Job in General Scale). Significant correlations (P < .05) emerged between each of the demographic variables and at least one of the criterion measures of job satisfaction. In addition to descriptive statistics and correlation analysis, a stepwise linear regression-correlation analysis showed that salary, degree level of nursing students taught, and length of annual contract were significant indicators of nurse faculty job satisfaction. (Abstract by: Author)


OBJECTIVE: The authors explore the relation between leadership style and empowerment and its effect on job satisfaction among the nursing staff of a regional medical center. BACKGROUND: Several empirical studies on transformational leadership-found that transformational leadership behaviors were positively related to work team success and leadership effectiveness. Transformational leadership processes have also been suggested to enhance followers' work-oriented values and shape the self-efficacies of followers. Employee empowerment may be influenced by the perception that the organization cares about its employees' well-being and that their work is valued. Empowering nurses may increase job satisfaction and improve patient care. Leadership style and empowerment influence job satisfaction among workers. METHODS: All nursing department staff were invited to complete a self-report questionnaire with no identifying information. Leadership style was measured using Bass's Multifactor Leadership Questionnaire, empowerment was measured with items from Spreitzer's Psychological Empowerment instrument, and job satisfaction was measured by Warr, Cook, and Wall's job satisfaction questionnaire. RESULTS: Both transformational and transactional leadership were positively related to job satisfaction, as was empowerment.
Differences in the contributions of empowerment and leadership style in predicting job satisfaction for licensed and unlicensed workers was evident. CONCLUSION: Designing interventions that allow for the relative influence of leadership style as well as empowerment on varying classifications of nursing personnel may be a more effective strategy and have a greater effect on staff attitudes and behaviors. (Abstract by: Author)

By using appropriate management styles, nurse managers can affect staff nurse job satisfaction. A study of 623 staff nurses in three Midwestern hospitals shows staff nurse job satisfaction clearly improves as the management style nears the participate management style. (Abstract by: Author)

1. Data were collected from an anonymous mail survey of over 2,000 paramedics and firefighters to determine the relationships among years of service and four occupational outcomes, including burnout. 2. Paramedics had poorer outcomes than firefighters. Job title, not percent of emergency service runs per se, significantly differentiated the groups with respect to burnout and job aspiration variables. 3. After adjusting for age, years of service correlated negatively with three measures of job aspirations: job satisfaction, work related morale, and career goal attainment in both groups. 4. If signs and symptoms of burnout occur throughout the worker's life cycle rather than with increasing years of experience, the findings have implications for both prevention and intervention strategies. (Abstract by: Author)

In rural practice settings where the task of recruiting new employees is exceedingly difficult, the first step in surviving the nursing shortage should begin with maintaining existing resources. Based on a survey of 2,488 staff registered nurses working in rural community hospitals, the authors compare personal, demographic, and practice characteristics of nurses by their self-reported intentions to stay in their present positions. Specific areas of job dissatisfaction that best distinguish those who anticipate leaving in 1 year from those committed to remaining in their present job for 5 years or more are identified. (Abstract by: Author)

An integrated model of turnover incorporating personal, organizational, and job experience variables as well as job attitudes and behavioral intentions as predictors of voluntary turnover among staff nurses was tested. Results confirmed the hypothesis that intention to leave would be the most immediate determinant of actual turnover. Personal, organizational, and job experience variables were found to influence voluntary turnover only indirectly through their effects on three attitudinal variables: felt stress, job satisfaction and organizational commitment, and intention to leave. As hypothesized, the strength of the intention-turnover relationship decreased as the time interval between expressed intentions and turnover behavior increased. (Abstract by: Author)

In this study, the mean age was 41 and these nurses had been out of school for approximately 13 years. Over half of these RNs had never been taught delegation skills in
nursing school. Of those who were exposed to the concept of delegation, their skills were not adequate to meet the patient care demands in the restructured health care system. During these challenging periods in health care, it is imperative that nursing service administrators provide RNs with the continuing education necessary to develop delegation strategies to adapt to their evolving professional roles. Continuing education classes on delegation skills are requisite for RNs practicing in a competitive managed care environment. As we approach the year 2000, the economic climate will dictate that RNs be skilled not only as clinicians, but also as leaders of the health care team. The findings of this study support that delegation decision-making skills enhance job satisfaction in the areas of decision making and promotional opportunity. Delegation knowledge is crucial to the successful direction of the health care team in the managed care environment. (Abstract by: Author)


The goals of this article are: 1) to surface those inherent design flaws in turnover research and point out how they confound the results in typical turnover studies; 2) to call for a fundamental change in the way researchers think about and analyze employee turnover; and 3) to demonstrate the application of an innovative methodology which redefines the problem of employee withdrawal.


Dissatisfaction and rapid turnover of registered nurses (RNs) challenge nurse administrators. The professional practice model (PPM) can increase the amount of personal control nurses have over their work. Use of a PPM allows innovation, promotes collegial relationships and emphasizes personal responsibility. In this study, facilitating an autonomous climate for RN practice resulted in increased job satisfaction and decreased. (Abstract by: Author)


The implications for the current nursing shortage of the job satisfaction and dissatisfaction described by 252 members of the American Nursing Association are discussed. Comparison of sources of dissatisfaction by the frequency with which they were mentioned, the strength of emotion with which they were expressed and their potential to provoke defection from nursing, indicate inadequate working conditions and counter-productive attitudes within employing organizations to be the most serious sources of dissatisfaction. Dissatisfaction with remuneration and benefits rank second to structural problems, by each measure. The relative importance of problems with gender and family roles, colleagues, education, and professional associations, and of respect, recognition, and autonomy issues are also discussed. (Abstract by: Author)


If you’ve grown weary of your work, try these strategies to renew your sense of commitment, fulfillment, and joy in nursing.

The findings of two consecutive surveys of job satisfaction and burnout in national samples of health care social workers are presented. Between 1979 and 1989, there were significant increases in the proportion of social workers employed in private versus public agencies, in quantitative workload, and in social workers' perceptions of the challenges presented by their jobs. Role conflict and role ambiguity, lack of comfort, and dissatisfaction with financial rewards emerged as significant predictors of depersonalization and burnout. However, a significant increase in social workers' feelings of personal accomplishment also occurred, and high challenge emerged as a significant predictor of sense of effectiveness. (Abstract by: Author)


The purpose of the study was to compare job satisfaction, absenteeism, and turnover between nurses working in a nurse-managed special care unit (SCU) and those working in traditional intensive care units (ICU). A case management practice model with a shared governance management model and minimal technology was implemented in the SCU while contrasting features of a primary nursing practice model with a bureaucratic management model and high technology already in place in the traditional ICU. Individual nurses' perceptions of and their preferences for the SCU practice model also were examined related to job satisfaction. Using analysis of covariance, greater satisfaction with a lower absenteeism rate was found in nurses working in the SCU. Nurses' perceptions and preferences for the SCU practice model were closely related to their job satisfaction and growth satisfaction. The findings suggest that individual perception and preference should be taken into account before implementing autonomy, authority, and responsibility at the organizational level to lead to the desired nurse outcomes in a given working environment. (Abstract by: Author)


How are costs of nursing care affected when professional nurses practice nursing based on patient's needs as opposed to institutional policy? The author discusses a different nursing care delivery system that builds on primary nursing but frees the nurse from institutional constraints. The results were a 20% decrease in nursing costs and increased satisfaction among the nursing staff participants. (Abstract by: Author)


Researchers have demonstrated repeatedly the importance of the relationship linking job satisfaction to employee retention. In rural areas of the country, where a persistent maldistribution of nurses continues to hamper health care delivery, the potential benefits of bolstering retention via enhancements in job satisfaction are of utmost utility to administrators and providers alike. Data were gathered from a multi-state survey of registered nurses (RNs) practicing in rural hospitals, skilled nursing facilities, and community/public health settings (N = 1,647; response rate = 40.3%). The investigators found that the use of tuition reimbursement corresponded significantly with increased levels of job satisfaction among nurses in all three practice environments, as did day care services for nurses in acute care settings. Also, among hospital-based RNs, level of nursing education was found to be a significant factor in the
relationship between tuition reimbursement and job satisfaction, with the highest level occurring among diploma-prepared nurses. (Abstract by: Author)


Results from the CMA’s 1998 Physician Resource Questionnaire are in, and they point to a serious decline in physician morale. The PRQ, the country's most important poll of physician attitudes, provides an annual "state-of-the-nation" message for the medical profession. (Abstract by: Author)


OBJECTIVE: As the healthcare system restructures, changes are being made that appear to influence nurses' jobs and satisfaction, yet little is known about effects on job characteristics and related outcomes. The authors present findings from a research project designed to identify links between specific aspects of hospital staff nurse (SN) practice and perceived job characteristics and psychological states, thought to have motivational consequences. BACKGROUND: The Job Characteristics Model (JCM) is the dominant paradigm in contemporary job design theory and research. Although generally well-supported, the JCM has limitations that constrain its usefulness: first, the Job Diagnostic Survey used to assess perceived characteristics does not indicate the specific aspects of activities that lead to these perceptions, and second, the JCM, based primarily on manufacturing research, does not include interpersonal job characteristics that seem important in human service jobs. METHODS: Two studies were conducted using a similar methodology. Focus groups of SNs were held to identify links between specific activities and characteristics and sources of satisfaction in SNs' job content. The Staff Nurse Job Characteristics Index (SNJCI) was developed to assess the presence of certain elements and activities in a nurse's job. An initial sample of 63 and a second sample of 146 SNs from Medical/Surgical and Coronary Care units completed the SNJCI, the JDS, and a demographic form through a mail survey. RESULTS: Internal consistency reliabilities (Cronbach's alpha) for eight of the nine SNJCI scales were acceptable. Correlation analysis indicates that job characteristics are meaningfully related to psychological states and job satisfaction. Findings support the hypothesis that specific aspects of SNs' jobs are reliably related to characteristics. CONCLUSIONS: Aspects of SNs' jobs important to their satisfaction include continuity in nurse-patient relationships, authority to initiate independent nursing actions, individual accountability for clinical outcomes, and regular performance feedback from managers. (Abstract by: Author)


In April 1991 the Daphne Heald Research Unit at the Royal College of Nursing (RCN) started a three-year research project to assess the job satisfaction of nurses working in the community. This took place against a backdrop of considerable change in the organization and funding of community health care. Initially four NHS Trusts participated, one withdrew after the first year. A measure of job satisfaction was administered to the entire community nursing and practice nursing workforce in each area. The response rate varied from 74% (year 1) to 54% (year 2). Differences in satisfaction were detected between trusts, different groups of nurse and over time. Some nurses added comments to their questionnaire, voicing concerns over uncertainty, paperwork and a perceived change in ethos within their organizations. Trust managers interviewed as part of the study spoke of their strategies for local implementation of the national changes. (Abstract by: Author)

The restructuring of health care delivery systems and the redesign of nursing roles is creating dramatic changes in the work environment for nurses. Empirical evidence supports the relationship between work environment and job satisfaction of nurses. However, in order for research to be applicable to practice settings, more information is needed on the specific components of the work environment most salient to nurses. Therefore, the purpose of this study was to determine the effect of the organizational and unit work environment on nurses' job satisfaction. The results of this study indicate the importance of relationships in the work setting. A cohesive peer group may compensate for other frustrations from the work environment, and a supportive manager may buffer nurses from effects of less desirable environments. (Abstract by: Author)


The goal of this paper is to develop a conceptual model based on identity theory to specify the relationship between group incentives and pay satisfaction. Pay satisfaction, as currently measured, does not include items that directly measure group-based rewards, therefore, any changes in pay satisfaction associated with group incentive implementation would be the result of some spillover effect. Identity theory is employed to model this effect by delineating how group incentives tap salient work-related roles; the theory also has implications for various behavioral consequences. The research described in this paper tests two hypotheses derived from the conceptual model. These hypotheses are tested in two quasi-experimental field studies conducted in a high technology firm and a consumer products company that both implemented gainsharing programs. The findings indicate that gainsharing plans can be viewed as either a benefit or as part of individual pay based on the ability of the incentive plan to activate salient work-related roles. [47 ref.]


The purpose of this study was to investigate the range of career development relationships (CDRs) experienced by staff nurses in relation to the outcomes of professionalism, job satisfaction, and intent to stay. A sample of 390 Army staff nurses completed questionnaires measuring five CDRs--precepting, peer-strategizing, coaching, sponsoring, and mentoring--and the outcome variables. Findings indicated that 61% of the sample experienced a CDR, with the predominant CDR being coaching. No CDR affected professionalism; however, job satisfaction and intent to stay may warrant further investigation in relation to CDRs. The findings suggest that if nurses perceived that an interest was taken in their career development, and felt valued by the developer, then usually staff nurses viewed the relationship as professionally important. The perception of importance often influenced intent to stay in a positive direction. (Abstract by: Author)

Other Clinical Applications


Poor adherence to medication regimens may be contributing to the recent increase in asthma morbidity and mortality. We examined patient characteristics that may influence
adherence to twice-daily inhaled steroid regimens. Fifty adults with moderate to severe asthma completed questionnaires examining sociodemographics, asthma severity, and health locus of control. Adherence was electronically monitored for 42 d. Following monitoring, patients' understanding of asthma pathophysiology and the function of inhaled corticosteroids were assessed. Patient beliefs about the effectiveness and convenience of these medications, and their perception of communications with their clinician were measured. Mean adherence was 63% +/- 38%; 54% of subjects recorded at least 70% of the prescribed number of inhaled-steroid actuations. Factors associated with poor adherence were less than 12 yr. of formal education (p < 0.001), poor patient-clinician communication (p < 0.001), household income less than $20,000 (p = 0.002), Spanish as primary language (p = 0.005), and minority status (p = 0.007). In a multiple logistic regression analysis, less than 12 yr. of formal education (OR: 6.72; CI: 1.10 to 41.0) and poor patient-clinician communication (OR: 1.2; CI: 1.01 to 1.55) were independently associated with poor adherence. These results emphasize the importance of socioeconomic status and adequate patient-clinician communication for adherence to inhaled-steroid schedules. (Abstract by: Author)


This study found that clinical nurse specialists provide care at a lower cost than physicians and psychologists and with equivalent or better patient outcomes.


The general principles of cost-benefit analysis are applicable to health care issues, which are in particular need of carefully detailed study at a time when health care expenditures are increasing and when there is competition for scarce resources. There are limitations to such analyses, particularly in the evaluation of the many intangible values so important in the costs and benefits of health care. As examples of the methodology, a simplified cost-benefit analysis is presented for cholecystectomy for silent gallstones in terms of an individual patient, and a more complex analysis is presented for a national program for renal transplantation or chronic hemodialysis for end-stage renal disease. Finally, costs of intensive care support are presented. These examples illustrate advantages and disadvantages of a revealing type of analysis that will be applied with increasing frequency to future health care issues. (Abstract by: Author)


Managed care organizations are monitoring asthma to decrease costs relating to health care utilization. Comparisons between primary care providers and asthma specialists reflect better outcomes, treatment programs, and higher patient satisfaction and outcomes for less cost.


This article addresses the economic and clinical impact of self-infusion therapy and its psychosocial benefits.

The rationing of medical care prioritizes the need for early predictors of death in the surgical intensive care unit (SICU). We prospectively studied 100 consecutive SICU admissions, looking for predictors of early death in the SICU and the cost implications of these findings. Serial APACHE II scores on days 1, 3, and 5 were subjected to multinomial logistic regression analysis to determine significant predictors of death in the SICU on day 1. Survivors had significantly lower (p less than 0.05) mean day-1 APACHE II scores than had nonsurvivors (13.6 vs 22.1). Half of the patients with scores greater than 18 died, and all patients with scores on day 1 of 25 or greater died. Significant predictors of death on SICU day 1 were APACHE II scores, Acute Physiology Score, Glasgow Coma Score, creatinine level, and Chronic Health Evaluation Score. Forty-one patients had been transferred from community hospitals as a result of acute illness; this population accounted for two thirds of the deaths in the SICU. Ten of 18 nonsurvivors were predicted on day 1, with these patients incurring a total cost of approximately $1 million. If therapy had been modified on days 5, 10, or 15, the potential cost savings would have been $340,000, $240,000, or $140,000, respectively. Integration of the results of this study into the management decision-making process and treatment guidelines may reduce the cost of care in the SICU.


In a 1975 paper, Neuhauser and Lewicki analyzed a colorectal cancer screening policy approved by the American Cancer Society. Their analysis yielded an incremental cost per case detected in excess of $47 million. This vivid demonstration of the impact of marginal analysis is frequently cited by health economists and is often used for pedagogic purposes. The analysis is incorrect because of two fundamental errors. We have reanalyzed the protocol in two stages. After correction for these errors, the $47 million disappears, the marginal cost is quite modest and the policy appears to be defensible on economic grounds.


The cost-effectiveness of the Intensive Care Unit after three decades of development has yet to be demonstrated. Accurate ICU resource allocation is limited by our inability to measure cost-effectiveness. Measurement tools have been developed and refined that will give a prediction of in-hospital mortality of groups of critically ill patients. However, these measures will not predict with certainty individual patient outcomes, and take no account of quality of life. Methodology to examine long-term outcome and quality of life after intensive care is still in its infancy. Measurement of ICU cost is limited by a lack of cost-accounting models that not only reflect true cost but that are clinically applicable.


OBJECTIVE: The purpose of this study was to compare reasons for family physician (FP) referral of children for tonsillectomy to the indications for this surgery used by otolaryngologists practicing in the same region. METHOD: A checklist-type survey was sent to a random sample of 300 FPs and all of the practising otolaryngologists in Nova Scotia in the spring of 1995. RESULTS: There were significant differences between reasons for referral and indications for treatment in many areas, the most important of which was that over 60% of FPs referred cases because of parental insistence, while no surgeons operated for this reason. If
inappropriate referrals are taken to be those for which no specialist intervention occurs, it appears that there is a significant number of referrals. CONCLUSION: These results suggest that both FPs and parents require information about these common paediatric problems.


OBJECTIVE--To evaluate the long-term mortality and morbidity of critically ill elderly patients requiring intensive care. DESIGN--Prospective comparison of outcome of critically ill patients aged 75 years and older with patients aged 65 to 74 years. PATIENTS--Critically ill patients aged 65 years and older who required intensive care and who were recruited during a 3-month period. MAIN OUTCOME MEASURES--Duration of hospitalization, hospital charges, procedures used in the intensive care unit, mortality in the hospital and during the follow-up period, and quality of life of survivors during the follow-up period. RESULTS--Ninety-seven patients were included in the study; 54 were 75 years or older and 43 were aged 65 to 74 years. No significant difference was noted between the two groups for length of stay in the hospital, hospital charges, or mortality at 1 year. Severity of illness, as assessed by Acute Physiology and Chronic Health Evaluation score at the time of intensive care unit admission, was a better predictor of survival than age. Quality of life, as assessed by activities of daily living, perceived quality of life, and Center for Epidemiologic Studies-Depression score, were not significantly different in either group at 1, 6, and 12 months after discharge from the hospital. Most patients in both groups described their quality of life as adequate and were willing to receive intensive care again, if necessary. CONCLUSION--Age alone is not an adequate predictor of long-term survival and quality of life in critically ill elderly patients.


OBJECTIVE: To measure preferences for initial outpatient vs hospital care among low-risk patients who were being actively treated for community-acquired pneumonia (CAP). METHODS: Study patients included 159 patients with CAP, 57 (36%) initially hospitalized, who were identified as being at low risk for early mortality using a validated prediction model. Subjects were enrolled from university and community health care facilities located in Boston, Mass, Halifax, Nova Scotia, and Pittsburgh, Pa, participating in the Pneumonia Patient Outcome Research Team prospective cohort study of CAP. Three utility assessment techniques (category scaling, standard gamble, and willingness to pay) were used to measure the strength of patient preferences for the site of care for low-risk CAP. At the time of initial therapy or during the early recuperative period, patient preferences were assessed across a spectrum of potential clinical outcomes using 7 standardized pneumonia clinical vignettes. RESULTS: Responses to the 7 pneumonia scenarios indicated that most patients consistently preferred outpatient-based therapy. This pattern was observed regardless of whether patients had actually been treated initially at home or in a hospital. Patients (74%) who stated that they generally preferred home care for low-risk CAP were willing to pay a mean of 24% of 1 month’s household income to be assured of this preference. Preference for home care, as measured by the category scaling and the willingness to pay, persisted after adjustment for sociodemographic and baseline health status covariates. Sixty nine percent of interviewed patients said that their physician alone determined whether they would be treated in the hospital or at home. Only 11% recalled being asked if they had a preference for either site of care. CONCLUSIONS: Most patients, even those treated initially in a hospital, who were at low risk for mortality from CAP prefer outpatient treatment. However, most physicians appear not to involve patients in the site-of-care decision. More explicit discussion of patient preferences for the location of care would likely yield more highly valued care by patients as well as less costly treatment for CAP. (Abstract by: Author)

Current management of patients after an acute myocardial infarction (AMI) reflects a variety of approaches ranging from conservative to aggressive. Although each method is appropriate in certain subgroups, their application frequently lacks a scientific basis. Current, clinically relevant, evidence-based practice guidelines are needed for secondary prevention for survivors after an AMI. To meet this need, the California Cardiology Working Group was assembled to evaluate the available data from clinical trials and other published studies and develop evidence-based, cost-effective guidelines for clinicians to use as a basis for patient management after an AMI. The group consisted of 18 members, including cardiologists from academic institutions and physicians working in cardiac intensive care, private practices, and managed care settings, representing a broad spectrum of expertise pertaining to patients who have had an AMI. The members had expertise in cardiac intensive care, interventional cardiology, nuclear cardiology, lipid disorders, echocardiography, and cardiac rehabilitation. The intended audience for these practice guidelines includes all physicians who treat survivors of MI. A literature review of all relevant clinical trials and other published data about the natural history after AMI and the effects of current therapeutic modalities are discussed herein. Case histories served as models for application of the literature-based data. The recommendations for management were reached by consensus vote based on the scientific evidence. When more than one management option applied, this was recognized in the recommendations. The recommendations accompany the text. (Abstract by: Author)


Background: In 1992, Massachusetts launched a statewide managed care plan for all Medicaid beneficiaries. Methods: This retrospective, multiyear, cross-sectional study used administrative data from the Massachusetts Division of Medical Assistance and Department of Mental Health, consisting of claims for 16,400 disabled adult patients insured by Medicaid in Massachusetts between July 1, 1990 and June 30, 1994. The main outcome measures include annual rates of hospitalization, emergency department utilization, and follow-up care 30 days after discharge; length of inpatient stay, and per-person inpatient and outpatient expenditures. Results: Between 1991 and 1994, the likelihood of an inpatient admission decreased from 29% to 24% and was accompanied by a slight reduction in length of stay (median number of bed-days per admission dropped by 3.3 days). There was a slight decrease in the number of patients who sought care in general hospital emergency department utilization. However, there was a small increase in the fraction of patients readmitted within 30 days of discharge. Medicaid and Department of Mental Health expenditures for mental health per treated beneficiary decreased slightly, from $11,060 to $10,640, during the 4-year study period. Conclusion: Although per-person expenditures dropped and most patient patterns of care remained the same, longer-term study is recommended to assess whether the trends can be maintained.


The high cost of health care has become a nationwide concern and there are several national initiatives under way to reduce the rate of increase of these costs. Among the most recent initiatives has been the introduction of Medicare reimbursement based upon Diagnostic Related Groups (DRGs). This paper presents a retrospective analysis of the costs of care of burned patients admitted to the University of Alabama at Birmingham Burn Center and a profile of the financial impact of DRGs. Costs for burned patients were twice as high as for the
average patient in the hospital and increased at a faster rate. Since 1977 the proportion of indigent patients and patients with very poor third-party coverage has greatly increased and those with good or excellent third-party coverage has decreased. If the care for Medicare patients had been reimbursed on the bases of DRG rates in 1982, payments would have exceeded costs by $2,981 but would have been $88,399 less than charges. In 1983, if the care for Medicare patients had been reimbursed on the bases of DRG rates, the payment would have been $409,629 less than costs and $634,583 less than charges. This very unfavorable reimbursement is because DRG reimbursement is essentially a flat rate and for long lengths of stay costs are much greater than reimbursements. Specific policies on methods to correct this discrepancy are suggested.


Significant amounts of scarce resources are devoted to medical research, but there have been few attempts to assess whether the benefits to society of these investments exceed the costs. A method for undertaking such an assessment has been developed and applied retrospectively to the Diabetic Retinopathy Study, a major clinical trial funded by the National Eye Institute from 1972-1981. It was estimated that the trial, which cost $10.5 million, generated a net saving of $2816 million to society ($231 million when the costs of lost production are excluded) (1982 prices) and a gain to patients of 279,000 vision years. This approach could be applied prospectively in considering priorities for medical research, in conjunction with traditional criteria such as the scientific merit of the proposal and the capabilities of the investigators. The key factors affecting the economic returns from medical research are the prevalence, incidence and economic burden of the disease in question, the costs and effectiveness of the medical intervention concerned, the likely impact of the clinical trial on clinical practice and the likely time-span of benefits from knowledge obtained during the trial.


An economic evaluation was undertaken concurrently with a randomized trial comparing a Caregiver Support Program (CSP) with existing conventional community nursing care for those caring for elderly relatives at home. The differences in resource consumption were compared with changes in caregiver quality of life, as measured by the Caregiver Quality of Life Instrument (CQLI). A 20% difference from baseline in the CQLI favored the experimental (CSP) group, although this did not reach conventional levels of statistical significance. A comparison of improvement in quality of life with costs implies an incremental cost per quality-adjusted life year gained of Canadian $20,000 for the CSP, which compares favorably with other health care interventions. Further, larger studies are required to confirm this result.


In most countries, the resources for the provision of health care are increasingly stretched in the face of competing demands for their use. This has simulated interest in methods of assessing the 'value for money' from health service instruments. In the past those providing rehabilitation services have often been at the end of the queue for health service resources and there is a danger that they will also be left behind in the race to demonstrate 'value for money' from their programmes. This paper outlines the methods of economic evaluation in health care, critically reviews their application to rehabilitation programmes to date and discusses how economic analysis could be conducted alongside a clinical trial of an active
rehabilitation programme for stroke patients. It is argued that, despite the methodological difficulties, there ought to be more economic evaluations of rehabilitation programmes in the future. (Abstract by: Author)


OBJECTIVE--To examine the cost-effectiveness of approaches to the diagnosis and treatment of patients with type II (non-insulin-dependent) diabetes mellitus (NIDDM) who have foot infections and suspected osteomyelitis. DESIGN--Decision and cost-effectiveness analyses were performed using a Markov model. We examined the prevalence of osteomyelitis, the major complications and efficacies of long-term antibiotic therapy and surgery, and the performance characteristics of four diagnostic tests (roentgenography, technetium Tc 99m bone scanning, indium in 111-labeled white blood cell scanning, and magnetic resonance imaging). Data were drawn from the English-language literature using MEDLINE searches and bibliographies from selected articles. SETTING--Primary care. PATIENTS--Patients with NIDDM who had foot infections and suspected osteomyelitis but no signs of systemic toxicity. INTERVENTIONS--Following hospitalization for surgical debridement and intravenous antibiotic therapy: (1) treatment for presumed soft-tissue infection, (2) culture-guided empiric treatment for presumed osteomyelitis, (3) 71 combinations of diagnostic tests preceding antibiotic therapy for osteomyelitis, (4) 71 combinations of tests preceding amputation, and (5) immediate amputation. MAIN OUTCOME MEASURES--Quality-adjusted life expectancy, average costs. RESULTS--Culture-guided empiric treatment for osteomyelitis with 10 weeks of oral antibiotic therapy has similar effectiveness to testing followed by a long course of antibiotic therapy if any test result is positive. However, empiric treatment is the least expensive strategy. CONCLUSIONS--Noninvasive testing adds significant expense to the treatment of patients with NIDDM in whom pedal osteomyelitis is suspected, and such testing may result in little improvement in health outcomes. In patients without systemic toxicity, a 10-week course of culture-guided oral antibiotic therapy following surgical debridement may be as effective as and less costly than other approaches. (Abstract by: Author)


BACKGROUND AND OBJECTIVES: Management of upper respiratory infection (URI) was examined in a family practice clinic to determine evidence-based practices, specifically for medication choice. Scientific evidence supports the use of decongestants and perhaps decongestant/antihistamine combinations in adolescents and adults and antipyretics in all age groups. The use of cold preparations for children younger than age 5 is not evidence based. METHODS: Data on demographics, medications prescribed, and over-the-counter medications recommended were collected from patient charts for 293 URI visits over a 6-month period. The cost of evidence-based URI treatment was compared with the cost of nonevidence-based treatment. RESULTS: Thirty-three percent of patients younger than age 5 were given a prescription; 96% of the prescription cost in this age group was nonevidence based. Twenty-six percent of all patients seen were given unnecessary and potentially harmful medication. These unnecessary medications accounted for almost 60% of the total prescription cost. Various combinations of antihistamines, decongestants, and antitusives were most commonly prescribed. CONCLUSIONS: Few medications have been shown to effectively alleviate the symptoms of the generally self-limited, benign common cold. Medications are often over prescribed, escalating health care costs and, in some cases, exposing the patient to dangerous side effects. Family physicians and educators are encouraged to reexamine their treatment and teaching practices for the common cold. (Abstract by: Author)

Objective: To analyze the costs and benefits of alternate cervical cancer screening schedules among elderly women in population-based screening programs. Results: Triennial screening reduced mortality from cervical cancer among the elderly by 74% at a cost of $2254 per year of life saved. Annual screening increased costs to $7345 per year of life saved; less frequent schedules yielded lower costs but decreased savings in life. These results were most sensitive to the quality of the Pap smear and the characteristics of the women using the benefit. Conclusion: The data show that after a woman 65 years of age or older has had a history of regular negative smears, screening is inefficient and can cease.


OBJECTIVE: To assess the costs and benefits of various approaches to early detection of developmental disabilities. DESIGN: Cost-benefit analyses based on data from previously published studies of developmental screening tests. SETTING: General pediatric practices and day care centers. PATIENTS AND OTHER PARTICIPANTS: A total of 247 parents and their 0- to 6-year-old children-103 from day care centers and 144 from pediatric practices. MAIN OUTCOME MEASURES: Licensed psychological examiners administered a screening test of parents' concerns about children's development and one or two direct screening tests: the Denver-II and/or the Battelle Developmental Inventory Screening Test. For the day care sample, examiners also administered to each child measures of intelligence, adaptive behavior, and language. In the pediatric sample, children were administered additional assessments. At the same time, diagnostic measures were administered to a randomly selected subsample to make determinations about developmental status. Each screening method was evaluated for its short-term costs (administration, interpretation, diagnosis, and treatment) and long-term benefits (impact of early intervention on adult functioning as inferred from longitudinal studies by other researchers). RESULTS: When the long-term costs and benefits were considered, none of the approaches emerged as markedly superior to another. When viewing the short-term costs, the various screening approaches differed markedly. The use of parents' concerns was by far the least costly for physicians to administer and interpret. CONCLUSION: Physicians can incur tremendous expenses when attempting to detect children with developmental problems. Although the benefits of early detection and intervention are substantial, physicians are not well-compensated for providing a critical service to society. Health policymakers and third-party payers must reconsider their minimal investment in early detection by health care providers. Nevertheless, our findings have encouraging implications for practice, because the use of parents' concerns as a screening technique offers substantial savings over and above other methods. (Abstract by: Author)


This study evaluated the 12-month follow-up results and costs of a personalized, medical office-based intervention focused on behavioral issues related to dietary self-management. Two hundred and six adults having diabetes attending an internal medicine outpatient clinic visit were randomized to either usual care or to brief intervention. The single session intervention involved touchscreen computer-assisted assessment that provided immediate feedback on key barriers to dietary self-management, goal setting and problem-solving counseling. Follow-up components included phone calls and videotape intervention relevant to each participant. Brief intervention produced significantly greater improvement than usual care on multiple measures of change in dietary behavior (e.g., covariate adjusted
difference of 2.2% of calories from fat; p = 0.023) and on serum cholesterol levels (covariate adjusted difference of 15 mg/dl; p=0.002) at 12-month follow-up. There were also significant differences favouring intervention on patient satisfaction (p<0.02) but not on HbA1c levels. The costs of intervention ($137 per patient) were modest relative to many commonly used practices.


Evaluating the use of resources, as well as outcomes in cancer therapy, is increasingly becoming recognized, by both clinicians and others, as a legitimate and indeed even desirable activity. While this trend is to be welcomed if it facilitates the efficient use of resources for cancer care, there are dangers in applying estimates of unit costs, in particular average costs to the evaluation of trends in practice in cancer therapies. This article examines the use of appropriate measures of average and marginal cost in the economic evaluation of developments in cancer therapy, taking illustrations from radiotherapy and chemotherapy. (Abstract by: Author)


To render quality-of-life scores on an instrument acceptable for cross-national comparison, the instrument's reliability and validity must be established in all countries in question. The Asthma Quality of Life Questionnaire-Marks (AQLQ-M) was developed in Australia, where it was shown to have good reliability and validity. However, no attempt had been made to determine the psychometric properties of the AQLQ-M and its domains (i.e., Breathlessness, Mood, Social, and Concerns) in the United States. The objectives of the present study were to administer the AQLQ-M to a sample of adult asthmatic patients in the United States (N = 106) and assess (1) the acceptability of the AQLQ-M to respondents, (2) the internal consistency of the AQLQ-M and its domains, and (3) the construct validity of the AQLQ-M and its domains. Results indicated that respondents did not have difficulty answering the questions in the AQLQ-M. The Cronbach coefficient alpha value for the AQLQ-M was 0.94. The Cronbach coefficient alpha value for individual domains ranged from 0.84 to 0.91, providing evidence of good internal consistency reliability for the AQLQ-M and its domains. Pearson product-moment correlations between the domain scores ranged from 0.62 to 0.88, indicating that the domains were related but separate aspects of asthma-specific quality of life, as measured by the AQLQ-M. Spearman rank-order correlations of the AQLQ-M score and domain scores with an indicator of disease severity-number of different prescription medications taken for asthma in the preceding 3 months-were positive and significant. This indicated that subjects taking a greater number of prescription asthma medications had higher AQLQ-M and domain scores, or a greater negative impact of asthma on quality of life, a result consistent with previous findings and one that provides some evidence of convergent validity. Our findings support the use of the AQLQ-M as a decision-making tool in the United States and in cross-national comparisons between the United States and Australia. (Abstract by: Author)


Small Iowa community hospitals (fewer than 500 deliveries annually) are currently the site of approximately 37% of hospital births in the state. Many of these facilities face severe financial constraints aggravated by reduced Medicare payments and diagnosis-related group payment mechanisms. The quality and quantity of services provided by small hospitals are
illustrated by birth and mortality data for the period that spans the development of Iowa’s regionalized perinatal care system. Small hospitals appear to compare very favorably when matched with their larger level I counterparts with regard to neonatal mortality rates, incidence of births of very-low-birth-weight neonates, survival of very-low-birth-weight neonates, occurrence of neonatal deaths relative to the total birth population, and incidence of neonatal morbidities. Because these hospitals provide valuable services in Iowa’s perinatal care system, their closure may seriously compromise perinatal health care for rural Iowans. (Abstract by: Author)


This study uses hospital records for 7,000 births in McLennan County, Texas, during the period June 1987-July 1989 to examine the association between prenatal care and birth outcome and the implications for hospital costs of newborn infants. After controlling for a variety of maternal and birth factors, a significant relationship between prenatal care and birth outcome remained. Females who failed to receive prenatal care were almost three times as likely to have a low-birth-weight infant (weighing less than 2,500 grams) than females who did. Using an ordinary least squares (OLS) estimating equation (R2 = .24), the net expected hospital cost savings for females who received prenatal care was over $1,000. (Abstract by: Author)


The constraints on medical-care resources can give rise to the question of the cost-effectiveness of permitting repeat medical procedures when some patients may die without undergoing even a first procedure. Using kidney transplantation as an example, this study estimates the cost-effectiveness of patients’ having available the option of a repeat medical procedure in the event the first procedure fails. Specifically, the analysis examines the effect on transplant candidates of having the option of kidney retransplantation, if and when retransplantation might be needed. Data sources include the U.S. Renal Data System (USRDS) Case-Mix Severity Study, Health Care Financing Administration (HCFA) data, and a MEDLINE search. Outcome measures include life expectancy, quality-adjusted life expectancy, lifetime costs of medical care, and marginal cost-effectiveness from a societal perspective. By avoiding lifelong dialysis after graft failure, first-transplant candidates gain an average of 47 quality-adjusted days with a retransplantation policy, despite the prolongation of time to first transplant by an average of 30 quality-adjusted days. The lifetime cost of medical care per first-transplant candidate is $1,210 higher with a retransplantation policy compared with the no-retransplantation policy; its societal cost-effectiveness is estimated to be $9,656 per quality-adjusted life-year saved. The retransplantation policy provides the greatest improvement in quality-adjusted life expectancy for younger candidates. In the case of kidney transplantation, the cost-effectiveness of a repeat transplant, on average, compares favorably with those of other medical strategies in common practice. As resources become increasingly constrained, this study demonstrates a framework for considering the cost-effectiveness of repeat medical procedures. (Abstract by: Author)


Women with coronary artery disease are less likely to undergo coronary artery bypass surgery, and this may represent a potential referral bias in favor of men. A higher in-hospital mortality rate in women compared with men has been reported earlier. Accumulating evidence currently suggests, however, that variables other than gender, such as advanced age, late referral, angina classification, diabetes mellitus, concurrent medical conditions, the number of
diseased vessels, the caliber of coronary arteries, and the decreased body surface area in women may have accounted for this difference. In fact, when these variables are taken into account, female gender is no longer a statistically significant predictor of operative mortality. Women appear to have comparable immediate and late survival rates. Recurrent angina, perioperative myocardial infarction, congestive heart failure, incomplete revascularization, and early and late graft reocclusion following surgery are, however, more prevalent in women. Men and women show differences in recovery experiences after discharge following bypass surgery. When coronary bypass surgery is offered to women, the decision should be individualized, based on the patients' perioperative baseline clinical risk factors and coronary anatomy. Coronary artery bypass surgery should not be withheld in women who are considered to be appropriate candidates for fear of a reduced success rate.


The costs to society of trauma care are huge. Multiple-injury patients in critical care units consume a vast percentage of the direct medical costs. This article examines the role that pre-existing diseases have on the length of stay in the critical care unit and the costs associated with this care. (Abstract by: Author)


Implementation of clinical pharmacy services in the current economic environment of the health care system requires cost justification of the service in addition to quality patient care services. Herein described is the evaluation of the cost effectiveness of a clinical pharmacy service implemented in an ambulatory care clinic of a regional Veterans Administration Medical Center. This evaluation assessed the ability of a clinical pharmacist to decrease the prescribing of nonsteroidal anti-inflammatory drugs (NSAIDs) by clinic physicians. Through analysis of prescription data prospectively collected for a period of 18 months, average cost of NSAIDs both before and after initiation of a clinical pharmacy presence was evaluated. A comparison was made between Evaluation Clinic providers (EC) and all other ambulatory care providers (OAC). The decrease in the average cost/prescription of NSAIDs for EC and OAC was 23.4% and 5.2% (P < 0.005), respectively. This decrease was associated with a net annual savings in drug costs of $38,776. This single intervention cost-justified a clinical pharmacist's position.


OBJECTIVE. To develop a basic benefit package for detection and treatment of early breast cancer by evaluating the effectiveness and costs for screening mammography, primary surgery, adjuvant therapy, and follow-up care. DATA SOURCES. Published articles were retrieved through MEDLINE; additional articles were obtained through searches of their bibliographies. Cancer statistics were taken from Surveillance, Epidemiology, and End Results (SEER) Program data, population statistics were taken from US Census data, and charges from 1993 Southern California Medicare fees were used to represent costs. STUDY SELECTION. Studies were selected on the basis of their design. Preference, in decreasing order, was given to meta-analyses of randomized trials, individual randomized clinical trials, prospective cohort studies, retrospective cohort studies, and case series. DATA EXTRACTION. Studies were examined for the effect of the intervention on overall survival, disease-free survival, and health-related quality of life. We evaluated effects on survival in terms of number of lives saved at 10 years and average years of life saved. Costs were related to the benefits observed and modeled onto a hypothetical health care organization of 500,000 lives. RESULTS. Based on
this analysis, we recommend a basic benefit plan for the detection and treatment of early breast cancer that would include the following: (1) screening mammography only for women aged 50 to 69 years; (2) choice of mastectomy or breast-conserving surgery with radiation therapy for all women with early breast cancer; (3) adjuvant therapy for all women at risk of recurrence; and (4) only clinical follow-up without routine testing for metastatic disease. CONCLUSIONS. By choosing which services they provide to specific groups of patients, providers can substantially reduce their expenses and still provide quality health benefits. (Abstract by: Author)


The objective of this study was to assess the cost-effectiveness of magnetic resonance angiography (MRA) imaging for renal artery stenosis (RAS) in people with progressive renal failure (PRF). We created a simulation model to determine the incremental cost-effectiveness of MRA screening in PRF compared with the fallback strategy of not screening. Costs, probabilities, and utilities were estimated from the literature and from institutional data. In our baseline analysis, assuming a sensitivity of 0.85 and a specificity of 0.8 of MRA for RAS, we obtained an incremental cost-effectiveness of MRA screening compared with no screening of $2,214 per quality-adjusted life year saved, which is less than the many commonly performed procedures. Under our baseline assumptions, if the receiver-operating characteristic curve of MRA for RAS is better than the chance curve, then MRA screening would be cost-effective. The analysis was most sensitive to assumptions about renal function after correction of RAS and prevalence of RAS, although the results show that MRA remains cost-effective for reasonable ranges of these assumptions. The use of MRA in PRF would be a worthwhile investment of resources in comparison with many currently funded procedures. The expense and morbidity associated with end-stage renal disease make any reasonable way of delaying or preventing the disease worth examining in detail.


This study presents a review of 961 patients treated in the general intensive care unit (ICU) of Akershus Central Hospital (ACH) from 1978 to 1981, including also a follow-up study of the 419 patients treated in 1978 and 1979 who were observed for an average period of 20 months after admittance to the ICU. The ICU patients represented 1.7% of all the patients admitted to the referring departments. Approximately 2/3 (67.3%) of the patients were surgical patients, representing 2.9% of the patients treated in that department, 19.6% were medical patients, and 8.6% came from the department of pediatrics. Surgery was the main reason for ICU admittance in 48.1% of the patients; in 70% of these, surgery by itself made postoperative intensive care necessary. Acute or chronic cardiovascular or respiratory disorders caused or contributed to ICU admittance in 78% of the patients; disorders of the nervous system (29.0%), gastrointestinal system (25%), and severe infections (28%) came next. The average stay in the ICU was 6.2 days. The patient's need for observation, nursing and therapy was assessed daily according to a care grade scale from 1 to 5, with 5 as maximum effort. The average care grade during the stay, multiplied by the duration of stay in days, gave the care product, which was used as an expression of the patient's need for ICU resources. The sum of care products for all the patients through 1 year thus expressed the total work load on the ICU. The ICU budget for 1 year, divided by the total care product for the same year, and thereafter multiplied by the care product for single patients or patient groups, was used as the basis for calculation of ICU costs. Patients receiving mechanical ventilation required 95% of the total work load in the ICU, and 66.3% of these efforts were directly associated with the ventilator treatment period as judged by the care product. Complications to treatment were recorded in 7.3% of the patients, and four of
these patients dies of such complications. Improvement by intensive care was achieved in 81.4% of the patients, 5.2% were unchanged, and 13.4% died while in the ICU. Mortality was 9.5% below and 19.3% above the age of 60 years. Of the 419 patients who were followed for an average period of 20 months after admittance to the ICU, 56 died in the ICU, 28 died later during the same stay in ACH, and another 47 died after discharge from ACH, whereas 288 (68.7%) were still alive. Below thirty years of age the total mortality was 13.4%, and above 60 years 44% of the patients were dead at the end of the observation period. A reduced state of health prior to the ICU-treated illness, malignant disease and advanced age were the three factors having the most negative impact on the long-term survival. The surviving patients were rehabilitated to a surprisingly high degree at the end of the observation period: 95.9% were living at home, 0.7% were dependent on support from family members, and only 2.9% of the total hospital budget.


BACKGROUND: Payment for experimental treatments using medical necessity criteria has been controversial. The process of obtaining a decision on coverage of an experimental treatment can be distressful for the treating physician, the patient, and family members.

METHOD: The techniques of evidence-based medicine were used to assist with treatment/coverage decisions concerning high dose chemotherapy with autologous bone marrow transplants (HDC/ABMT) for invasive breast cancer.

RESULTS: We reviewed the literature, finding minimal evidence for effectiveness of HDC/ABMT for invasive breast cancer; therefore, it is our opinion that it remains an experimental therapy. Its cost utility is likely to be low (approximately $100,000 per additional quality year gained). Numerous patients have been treated with HDC/ABMT outside of clinical trials, impeding scientific analysis of the treatment’s effectiveness.

CONCLUSION: Data-based policies and procedures for funding experimental medical treatments need to be developed to eventually replace the medical necessity criteria.


A telephone survey of a representative national sample of 51 large managed care organizations in the U.S. (> 50,000 enrollees) was undertaken (1) to understand the role of socioeconomic assessments on drug adoption decisions; (2) to determine the sources of these assessments and the reliance of managed care pharmacy on each; and (3) to determine the resources for internally versus externally performed drug assessments. Socioeconomic assessments (clinical effectiveness, safety, cost of treatment, cost-effectiveness, and quality of life) are often tied to formulary decisions. Plans differ in their use of externally available socioeconomic assessments and in their ratings of the importance to decision making of drug assessments from the various sources. Those using a specific source of drug assessment information rated them in the following order of importance: PBM assessments, other HMOs, peer reviewed literature, evaluations performed by industry, articles in non-peer reviewed publications and, lastly, government reports. Timeliness and comprehensiveness are important components of the overall utility of information. A high percentage of plans reported using some of the various types of assessments, with clinical effectiveness most common, and cost-effectiveness second. The percentage of new drugs that undergo assessments in each of the plans covers a broad range, with 57% of the plans evaluating at least half of all new drugs. All but one surveyed managed care plan reported having either implemented or plans to implement a disease management program. Eighty percent of those surveyed are more concerned about drug assessments than in the past and 88% anticipate greater future use. Although 38 plans
(75%) have a person in the organization responsible for drug assessments, this is the primary job in only 14 plans (37%). With greater reliance on drug assessments in the future, there are substantial opportunities for integrating drug assessments, formularies and disease management programs. (Abstract by: Author)


Among 1532 ICU patients we analyzed 295 elderly patients (19%) aged more than 70-years-old. We determined prospectively the immediate and subsequent one-year outcome with a study of the predictive value of their ICU admission parameters. Then we followed the ICU survivors over the year after discharge (1, 6, 12 months) by quality of life questionnaires. ICU mortality was 26.7%; SAPS was the only predictor of short term mortality. On ICU discharge, 216 elderly were followed at 1, 6, 12 months; the one-year cumulative mortality was 49% from ICU discharge, majority of deaths occurring over the first month. Age, previous health status and SAPS had a predictor value of one-year mortality for ICU survivors. 103 patients were alive at one year: 88% returned to home, 72% had a relatively good functional status allowing an independent life, and 82% had the same or improved functional status.


This article addresses the management of depression in primary care from the perspective of a health maintenance organization. The rise of managed care systems is briefly discussed with reference to their impact in choice of treatment strategies. Cost-effectiveness considerations pertinent to a health maintenance organization are reviewed. A simplified protocol for the treatment of depression with paroxetine or imipramine in the primary care sector is presented and used as an example of cost calculations. Given the assumptions used in this cost-effectiveness model, it appears that the costs of treating depression in primary care with paroxetine are approximately equal to those found with the use of imipramine. Higher acquisition costs of paroxetine are balanced by the greater labor costs associated with imipramine.


Any cost-benefit analysis of the use of an oral vaccine to control raccoon rabies should include calculating both costs and benefits in terms of $/unit area. Further, cost savings must be adjusted to match the stages of an epizootic: pre-epizootic, epizootic, and post-epizootic. A generic model, which can be adapted to different sites, illustrates the use of threshold analysis to link distribution costs, cost savings, bait density, and vaccine price. Initial results indicate the need to lower the cost of the vaccine, continue research to determine optimal bait densities, and examine distribution plans that do not require continued protection of areas in which raccoon rabies was eliminated through previous vaccination programs.


This study investigates whether timely referral to specialists, in this case orthopaedic surgeons, potentially can reduce the costs of a health care episode. Five musculoskeletal diagnoses were chosen, and the diagnostic and treatment history of approximately 2500 persons with these five diagnoses was traced to determine when in the course of their treatment episode they were referred from nonorthopaedist to orthopaedist care and how much their episode of care cost. It was found that the average episodic costs for those who were referred
earlier in the episode of care was lower than for those referred later. The implication is that there are likely to be numerous identifiable health conditions that should be flagged for early referral to specialists to reduce costs. It also questions the validity of the presumption that specialist care is necessarily more expensive. (Abstract by: Author)


The analysis of cost issues has become increasingly important in all fields of medicine. Understanding these economic analyses can make providers more cognizant of the ultimate health, economic, and social outcomes of their treatment decisions. The methodology of cost studies and the surgical costs of treatment of intracranial metastatic tumors warrant review. Costs of surgical and radiosurgical treatment are in the range of that for the care of other serious illnesses, but comparison of the available options is still sensitive to assumptions, and open to varied interpretations. (Abstract by: Author)


RESEARCH OBJECTIVE(S): Prevention is being promoted as a means to improve health status and to save health care costs. Economic evaluations of prevention (i.e., cost-effectiveness and cost-benefit analyses) indicate that some prevention activities, like many treatments, do not save money, although many are relatively cost-effective. It has been suggested, however, that prevention is held to a higher standard than treatment because prevention programs are expected to demonstrate cost savings, and that the methods of economic evaluation understate the cost-effectiveness of prevention. Although the converse assertion is less commonly made, economic evaluations may also overstate the cost-effectiveness of prevention. The objective of this paper is to examine how the methods of economic evaluation may systematically understate, or overstate, the cost-effectiveness (or net benefits) of prevention. STUDY DESIGN: We examine three key methods: (1) how future costs and benefits are valued ("discounting"), (2) how costs and benefits to people beyond those who are the users of prevention are valued ("externalities"), and (3) how non-monetary costs and benefits to individuals are valued ("intangibles"). We also assess how the recently issued recommendations of the Panel on Cost-Effectiveness in Health and Medicine apply to prevention. PRINCIPAL FINDINGS: We discuss several recommendations for each key method, using data from three studies to illustrate our points: a study on the cost-effectiveness of extending mammography screening to women ages 40-49, a study on the cost-effectiveness of HIV counseling and testing in primary care settings, and a study on the cost-effectiveness of a vaccine to prevent HIV. CONCLUSIONS: The methods of economic evaluation may both underestimate and overstate the cost-effectiveness of prevention. Many benefits of prevention are not included in economic evaluations, making prevention relatively less cost-effective, but there are also costs that are not included and assumptions that are made that make prevention relatively more cost-effective. RELEVANCE TO CLINICAL PRACTICE AND POLICY: The question is not whether prevention saves money, but whether it provides improved health for a reasonable cost compared to other alternatives. Similarly, the question is not whether to fund prevention or treatment, but what would be the relative mix. Economic evaluations will continue to be useful in informing decisions on the allocation of resources to prevention, although the methods used for economic evaluations should be carefully applied. (Abstract by: Author)
OBJECTIVES: To present an approach for assessing intensive care unit (ICU) performance which takes into account both economic and clinical performance while adjusting for severity of illness. To present a graphic display which permits comparisons among a group of hospitals.

DESIGN: A multicenter, inception cohort study.

SETTING: Twenty-five ICUs in U.S. hospitals that participated in the European and North American Study of Severity Systems for ICU Patients.

PATIENTS: Consecutive patients (n = 3,397) admitted to ICUs in participating hospitals between September 30, 1991 and December 27, 1991. Excluded were coronary care patients, burn patients, cardiac surgery patients and patients aged < 18 yrs.

MEASUREMENTS AND MAIN RESULTS: The clinical performance index is the difference between observed hospital survival rate and survival rate predicted by the Mortality Probability Model measuring severity of illness at ICU admission. The economic performance (resource use) measure is a length of stay index, Weighted Hospital Days, which weights ICU days more heavily than non-ICU days. The economic performance index is the difference between actual mean resource use and the resource use predicted by a regression including severity of illness and percent of surgical patients. Both the clinical and economic performance indices are standardized to show how far a particular hospital is from the overall mean and are graphed together. Most of the 25 hospitals lie within 1 SD of the mean on both clinical and economic performance scales. The graph makes it easy to identify those hospitals that are outside this range. There is no evidence of a trade-off between high clinical performance and high economic performance; i.e., it is possible to achieve both.

CONCLUSIONS: Cross-indexing of clinical and economic ICU performance is easy to calculate. It has potential as a research and evaluation tool used by physicians, hospital administrators, payers, and others. (Abstract by: Author)


The daily costs of 90 critically ill patients treated on an intensive therapy unit were calculated on an individual patient basis. Twenty-one patients (23%) died on the intensive therapy unit and another 13 (15%) died within one year of discharge. The results demonstrate that there is wide variation in costs among the patients and the diagnoses. The mean daily cost of nonsurvivors was almost 300 pounds greater than that of survivors (816 pounds (95% confidence interval = 649-982 pounds) versus 550 pounds (498-601 pounds). Renal failure, sepsis and pneumonia proved to be some of the most expensive conditions to treat, and postoperative respiratory failure the cheapest. The cost of the first day of management was significantly related to the APACHE II score and individual costs on the first day may be predicted from admission APACHE II score. Patients who die in the intensive therapy unit continue to incur the same level of expenditure throughout admission. The study could not provide conclusive answers concerning the trend in daily costs for survivors.


A questionnaire designed to assess changes in quality of life was sent to 56 survivors of critical illness one year after their admission to an intensive therapy unit. Forty-one patients completed the questionnaire and for the majority, quality of life remained unchanged (n=25). However, significant decreases in quality of life were found in those patients who previously enjoyed a good quality of life or were admitted with respiratory problems. Survivors also recorded significant decreases in five aspects of their perceived quality of life (ability to think and remember, seeing family, their contribution to society, activities outside work and income). As part of a previous study, the costs incurred by each of these patients had been measured so
that changes in quality of life detected in this study could be combined to the individual costs and expressed as cost per quality adjusted life year. The cost of intensive therapy for a patient surviving for one year after acute respiratory or cardiovascular disease was 2600 pounds. The total hospital cost per quality adjusted life year was estimated at 7000 pounds, which places intensive therapy at the higher end of health program costs. If the costs of nonsurvivors are included in the cost per quality adjusted life year calculation, the cost of intensive care increases considerably.


A preliminary study was performed to calculate the cost of intensive therapy on an individual patient basis. The fixed (equipment, supporting services and land opportunity), semi-fixed (staff) and marginal (treatment) costs of 20 critically ill patients were calculated individually. The results show that there is wide variation in intensive therapy costs. The average daily cost for a spontaneously breathing patient was 399 pounds (95% confidence intervals 388 pounds-460 pounds) while that for a ventilated patient was 726 pounds (656 pounds-795 pounds). The mean total cost per patient was 1980 pounds, but the cost per survivor increased by 16% (347 pounds) because of four deaths on the intensive care unit. High total costs are associated with increased severity of illness and higher marginal (treatment) costs are associated with increased semi-fixed (staff) costs. The cost of intensive therapy was three to five times that for general ward care.


This paper reviews problems encountered in estimating the unit cost of services provided by innovative mental health programs and illustrates methods for addressing these problems. Generally, the cost of a health care service is determined by identifying all resources used in its production and the cost of those resources. These costs are divided by appropriate workload measures to determine the cost per unit of service or per client. Issues that must be addressed include: 1) direct program costs; 2) indirect program costs (including administration and capital costs); 3) program resources used to support research and other non-program activities, and 4) identification of "typical" workloads as the program is implemented. Application of these methods is illustrated with data from a multi-site study of intensive psychiatric community care conducted at none Department of Veterans Affairs Medical Centers in the Northeast. A sensitivity analysis revealed that estimates of program costs vary by 59% over the entire program, and from 17%-168% at individual sites, depending on which cost estimation methods were included. The average cost of case management in this program varied considerably across sites, primarily reflecting differences in caseload size and staffing levels. Adjusting for inflation, the cost of this program falls below the cost of other published intensive community programs.


Screening is defined as the presumptive identification of unrecognized disease or defect by the application of tests, examinations, or other procedures that can be applied rapidly and carried out in the general population or in individuals at high risk. When considering immunochemical or biochemical cancer markers, it might be more appropriate to describe these tests as risk-factor monitors and introduce the concept of two interpretations of these tests: in asymptotic populations as indicators of probability of cancer, and in patients with previously treated cancer as predictors of recurrence despite initial treatment described as "curative." The successes of screening with (alpha)-fetoprotein for hepatocellular carcinoma and with catechol
metabolites in neuroblastoma are discussed. The major emphasis will be the possible use of CA 125 and prostate-specific antigen (PSA) in risk-factor assessment of ovarian cancer and prostate cancer, respectively. It is important to understand in what context a PSA value > 10 micrograms/L indicates a 67% probability of cancer.


OBJECTIVE: To estimate the excess costs of medical care for patients with diabetes in a managed care population and to determine the proportion of costs spent on treating the complications of diabetes. RESEARCH DESIGN AND METHODS: A comparison of 1-year (1994) costs of medical care in the 85,209 members of the diabetes registry of Kaiser Permanente, Northern California, and in 85,209 age- and sex-matched nondiabetic control subjects. Costs were obtained from automated program databases. Costs specifically related to treating acute and long-term complications of diabetes were identified, and the excess costs attributable to each complication in individuals with diabetes were calculated. RESULTS: Excess expenditures in individuals with diabetes totaled $282.7 million, or $3,494 per person. Per person expenditures for members with diabetes were 2.4 times those for matched control subjects. The largest proportion of total excess costs was for hospitalizations within the health maintenance organization (38.5%). Nearly 38% of the total excess was spent treating the long-term complications of diabetes, predominantly coronary heart disease and end-stage renal disease. CONCLUSIONS: Diabetes is a costly condition by virtue of its high prevalence and high per person costs. A large proportion of these costs are related to treating complications of diabetes. Available evidence indicates that several measures can reduce complication rates. Thus, effective disease management programs that aim to prevent complications could potentially lead to cost savings in managed care settings. (Abstract by: Author)


BACKGROUND. Evidence suggests that a number of end-stage renal disease (ESRD) patients die without receiving dialysis. We investigated and compared ESRD patients who died without receiving treatment and those who were accepted for dialysis. METHODS. All patients starting chronic dialysis in 1991 in the city of Sao Paulo and prospectively registered in the Health Secretariat files were studied. From death certificates we obtained data from all patients dying with an underlying cause associated with chronic renal failure. Medical records from a sample of patients who died without receiving dialysis were reviewed. RESULTS. Of 2127 patients, 1582 (74.7%) received dialysis and 545 (25.6%) did not. The best chance of being dialyzed occurred in the 20-29 age group. The age groups with the least chance of receiving dialysis were 0-9 years and over 79 years old. The odds ratio (95% CI) of not receiving dialysis was 12.42 (6.63-23.82) times greater for patients over 60 years old compared to those aged 10-19 years. Patients with renal failure due to congenital diseases, chronic pyelonephritis, unknown cause, and hypertension were less likely to receive dialysis than those with glomerulonephritis or diabetes. CONCLUSIONS. Our results suggest that many ESRD patients die without receiving dialysis. Age and cause of renal disease influence the chance of being accepted for treatment. Restrictions of treatment need to be corrected to guarantee that maintenance dialysis will be accessible to ESRD patients.


A significant portion of health care resources are spent in intensive care units with, historically, up to two-fold variation in risk-adjusted mortality. Technological, demographic, and social forces are likely to lead to an increased volume of intensive care in the future. Thus, it is
important to identify ways of more efficiently managing intensive care units and reducing the variation in patient outcomes. Based on data collected from 17,440 patients across 42 ICUs, the present study examines the factors associated with risk-adjusted mortality, risk-adjusted average length of stay, nurse turnover, evaluated technical quality of care, and evaluated ability to meet family member needs. Using the Apache III methodology for risk-adjustment, findings reveal that: 1) technological availability is significantly associated with lower risk-adjusted mortality (beta = -.42); 2) diagnostic diversity is significantly associated with greater risk-adjusted mortality (beta = .46); and 3) caregiver interaction comprising the culture, leadership, coordination, communication, and conflict management abilities of the unit is significantly associated with lower risk-adjusted length of stay (beta = .34), lower nurse turnover (beta = -.36), higher evaluated technical quality of care (beta = .81), and greater evaluated ability to meet family member needs (beta = .74). Furthermore, units with greater technological availability are significantly more likely to be associated with hospitals that are more profitable, involved in teaching activities, and have unit leaders actively participating in hospital-wide quality improvement activities. The findings hold a number of important managerial and policy implications regarding technological adoption, specialization, and the quality of interaction among ICU team members. They suggest intervention "leverage points" for care givers, managers, and external policy makers in efforts to continuously improve the outcomes of intensive care.


“A medicine's impact on the utilization of all health resources, including hospitalization and surgery, must be assessed." The article reviews several episodes of medical care in which cost-effectiveness was maximized by using therapies that, at face value, appeared to be very expensive.


This cost of illness analysis examines national cost and resource utilization by persons with asthma using a single, comprehensive data source, the 1987 National Medical Expenditure Survey. Direct medical expenditures included payments for ambulatory care visits, hospital outpatient services, hospital inpatient stays, emergency department visits, physician and facility payments, and prescribed medicines. Indirect medical costs included costs resulting from missed work or school and days with restricted activity at work. Point estimates and 95% confidence intervals (CI) were calculated and inflated to 1994 dollars. The total estimated cost was $5.8 billion (95% CI, $3.6 to $8 billion). The estimated direct expenditures were $5.1 billion (95% CI, $3.3 to $7.0 billion), and indirect expenditures were valued at $673 million (95% CI, $271 to $1,076 million). Hospitalization accounted for more than half of all expenditures. More than 80% of resources were used by 20% of the population (defined as 'high-cost patients'). The estimated annual per patient cost for those high-cost patients was $2,584, in contrast with $140 for the rest of the sample. Findings from this study indicate that future asthma research and intervention efforts directed at hospitalizations and high-cost patients could help to decrease health care resource use and provide cost savings. (Abstract by: Author)


The primary objective of this part of our study was to test the feasibility and--to some extent--the reliability of the proposed methodology, and to contribute to the solution of some minor difficulties in assessing treatment outcomes by means of simple easy-to-use quality
instruments. The data on which this study is based were obtained as part of a prostate disease screening programme in Antwerp.


Expenditures for medical care services continue to rise as a proportion of the total Gross Domestic Product (GDP) in most countries. Because a large share of resources are increasingly being spent on medical care services, there is a need to more closely examine the quality, cost and efficiency of all aspects of health care delivery. One method for assessing efficiency is cost-effectiveness analysis. Many of the elements of a basic cost-effectiveness model for asthma care are available, including accepted relevant studies on societal cost-of-illness, accepted health outcomes relevant to good clinical care, and a selection of potential intervention strategies, both for prevention and control. The purpose of this paper is to illustrate how an economic approach to decision-making can be used to assess the potential impact of alternative intervention strategies for asthma care. Two case studies are developed including a new management strategy for the chronic care of stable moderate asthma and a management strategy for the early detection and prevention of childhood asthma. It is proposed that economic modeling of possible intervention strategies can serve as a useful method for determining the potential impact (in terms of cost-effectiveness) of a proposed intervention strategy well in advance of any empiric clinical trials. Analysis such as these may prove valuable in protecting researchers from developing intervention strategies that are clinically efficacious but cost-ineffective and, therefore, are unlikely to be adopted by providers/payers of medical care services for asthmatics. (Abstract by: Author)


BACKGROUND: As disposable endoscopes become available, we need baseline costs associated with reusable instruments to make financially intelligent choices. Accordingly, we analyzed the per-use cost of several types of gastrointestinal endoscopes at our institution. METHODS: Records of 44 gastrointestinal endoscopes were analyzed. Data defined included purchase price, repair and cleaning expense (labor and materials), and number of uses. The labor cost per-use associated with endoscope cleaning was estimated by taking an average time required to clean an endoscope multiplied by the technician's salary. RESULTS: The average number of years of endoscope use varied from 4.6 to 6.9 years contingent on the type of endoscope. For flexible sigmoidoscopes, the average total cost per use was $8.35, and for colonoscopes the cost was $21.81. For gastrosopes and diagnostic and therapeutic duodenoscopes, costs were $20.99, $49.15, and $45.16, respectively. CONCLUSIONS: (1) Excluding costs associated with the procedure itself (admit-recovery, drugs, disposable equipment, and procedural personnel), total peruse scope cost ranged from a low of $8.35 for the flexible sigmoidoscope to $49.15 for the diagnostic duodenoscope. (2) The most important variables associated with per-use endoscope cost included number of uses, initial purchase price, and repair costs. (3) Techniques such as the above can be used to define per-procedure costs for a particular practitioner or institution. (Abstract by: Author)


Despite an expanding number of centres which provide lung transplantation, information about the incremental costs of lung transplantation is scarce. From 1991 until 1995, in The Netherlands a technology assessment was performed which provided information about the incremental costs of lung transplantation. Costs in the situation with and without a
transplantation programme were compared from a lifetime perspective. Because randomization was ethically inadmissible, only costs in the situation with the programme were observed. Both conventional treatment costs and costs of the transplantation programme were registered. Costs in the situation without the programme were based on the conventional treatment costs in the situation with the programme. Due to the study period of four years, long term follow-up costs were estimated. The total incremental costs per transplanted patient were estimated at Dfl 466,767 (5% discounted costs). The main part of these costs was caused by the high costs during the lifetime follow-up of the patients. (Abstract by: Author)


This study was conducted to examine the potential effects of expanded Medicaid coverage for low income women. Statewide birth data for 1983 to 1985 were examined to determine the relationship between prenatal care and admissions to neonatal intensive care units (NICUs) and the costs of this care. An NICU sample was constituted from infants who were discharged live following more than 7 NICU days, were referred to an out of state tertiary center, or died following NICU admission. Inadequate care (no prenatal care, only last trimester care, or less than five visits) was received by 11% of the total birth cohort and by 18% of the infants in the NICU sample (p<0.001). Infants with inadequate care had a NICU admission rate of 5.10% versus 2.86% for those with adequate prenatal care (p<0.05). Assuming that economic resources limit access to prenatal care, the projection can be made that had all women with inadequate prenatal care received Medicaid-covered adequate prenatal care, expenditure for this care would yield more than a two to one return in savings in NICU costs.


Most research in clinical psychology and related disciplines does not measure, report, or analyze costs, cost-effectiveness, or cost-benefit analysis. Reasons for this are discussed. It may be thought, for example, that costs are trivial to measure. Data are presented to show that the values of resources consumed in treatment (i.e., costs) actually can be quite complex to assess accurately and completely. Research findings are assembled to show that costs, as experienced by clients, may be beneficial to assess in that they can be significantly related to the outcomes of treatment. Empirical findings also show that costs also can be useful to measure because costs and outcomes can be related inversely rather than directly (i.e., clients may benefit most from treatments that cost less than several viable alternatives). Finally, perceived impediments to assessing costs and to cost-effectiveness and cost-benefit analysis in psychology are considered. Dialogue is encouraged on the scientific study of relationships between (a) monetary and other costs, (b) treatment techniques and treatment delivery systems, and (c) psychological and economic outcomes. (Abstract by: Author)

Other Applications of Methodology


The state of Oregon decided to cover all potentially eligible Medicaid citizens to 100% of poverty. Previously, Oregon had covered persons up to 67% of poverty. In order to keep overall program costs in check. Oregon decided to limit the number of services that its Medicaid program would cover. Oregon’s normative choice was to contain program costs by
covering all eligible persons up to 100% of poverty, while at the same time uniformly limiting access to certain services for everyone in the overall group of eligible persons. The state developed a prioritization list of medical services and priced the components on the list. The amount of money ultimately available for the Medicaid program was a political decision informed by data about the cost of different services and influenced by the priorities set through an independent process of priority-setting. Physicians were asked to determine what works medically, how well it works, and what benefits accrue to patients. Recognizing that physician perspectives on efficacy might vary from patients' perspectives on valuation of benefits, Oregon's planners developed a method for valuing medical outcomes that stemmed from particular medical interventions. This blend of medical fact and value to patients allowed for comparing valuations by introducing cost considerations. Condition-treatment (CT) pairs linked a medical condition with one or more courses of treatment. The goal was to determine the likely incremental medical benefit from a given treatment. In addition, Oregon developed a Quality-of-Well-Being scale to determine the net patient benefit from medical intervention and used a telephone survey to value that net benefit. A cost-benefit ratio was derived, and a prioritization of CT pairs was developed. The article analyzes and evaluates Oregon's use of cost-benefit calculations in the allocation of Medicaid funds, noting that Oregon itself backed away from many of the implications of its cost-benefit analysis and that the Americans with Disabilities Act has constrained use of quality-of-life judgments in Medicaid resource allocation decision-making. (Abstract by: Author)

Bowers, M.R., J.E. Swan, et al. (1994). “Influencing Physician Referrals: A Study into the Use of Information Sources Uncovers a Cost-Benefit Relationship at Work.” Journal of Health Care Marketing 14(3): 42-50. Primary care physicians have several external sources of information available when referring a patient to a specialist. The most-used sources were a fellow physician, followed by the specialist, the patient or the patient's family, and to a lesser extent, hospital-controlled sources including referral directories, call services, and sales representatives. The authors tested a cost-benefit model where source usage was predicted to increase as the costs of using the source decreased and benefits increased.

Butcher, A.H. and J.C. Szekely (1998). “Report from the Front Lines: Rural Medicaid Primary Care Providers as Gatekeepers of Rural Health Service Networks.” Journal of the Louisiana State Medical Society 150(8): 372-383. This study of primary care practitioners in Louisiana's Medicaid managed care program, Community Care, focused on the program's implementation and perceived impact. PCPs were interviewed to assess their perceived responsibilities as gatekeepers and how well they believed the system facilitated or impeded their fulfillment of those responsibilities, to examine issues of access and quality, and to determine their knowledge and use of local referral networks. Findings indicate that although they appreciated the financial stability derived from having a larger patient base and understood their roles well, they were concerned with several facets of the program, including perceived limitations imposed on their medical decision making, an added burden of paperwork, and a lack of both downward and upward communication. They also believed the referral network of available providers for medical and social services to be more limited for their Medicaid patients than for their private patients. Policy implications are discussed.

Chiozza, M.L., A. Suppiej, et al. (1997). “Evoked Potentials in Pediatrics: Economic Audit.” Childs Nervous System 13(3): 166-170. In the present era of resource management, there is increasing emphasis on the need to make the best possible use of available resources. We therefore measured the productive
factors directly involved in performance of 59 evoked potential examinations (brainstem auditory evoked potentials, BAEPs; flash visual evoked potentials, F-VEPs; and electroretinograms, ERGs) in different pediatric age groups. In order to ascertain the gap between the costs of instrumental examinations performed in our service on children and the fees reimbursed by the Italian national health service (NHS) a breakdown was made of the costs of tests and their scheduling in relation to the different age variables involved. It was found that the fees reimbursed do not cover the real costs, because they underestimate the actual consumption of resources. The findings recorded indicate that for pediatric tests the economic audit should be graded according to the ages of the children examined and should include an analysis of different test phases. The economic audit should also be considered a preliminary step in clinical audit. It is concluded that it is financially punitive to reimburse a pediatric service with a fee based on the examination of adults, because in pediatrics the variable "age" influences the duration and complexity of tests and also their interpretation.


The annual surveys of the American Hospital Association historically have been only national source of statistics on hospital structure and performance. Although valuable, this source has not provided the policy or research community with hospital-specific information on revenues, assets, and financial status. Data on these and other variables from heretofore unpublished Medicare cost report data are presented in this article. Hospital expenses, revenues, profits, indebtedness, utilization, investments, and employees are trended over the 1970-81 period by urban-rural location, teaching status, and ownership. It is indicated in these data that a major transformation in the hospital industry has occurred in response to cost-based Medicare-Medicaid and other factors that made acute care essentially unaffordable to the average citizen. The health maintenance organization movement and Medicare's prospective payment system are seen as logical reactions to this transformation. (Abstract by: Author)


This paper takes advantage of a unique set of annual MONITREND data from the American Hospital Association (AHA) to study the effects of Medicare's Prospective Payment System (PPS) and other public/private programs on hospital productivity and intensity between 1980 and 1987. The results on over 30 cost centers show major improvements in inpatient productivity per discharge in the first two years of PPS--improvements that are largely attributable to shifts of care to the outpatient department. Inpatient intensity, which was growing 4.5% annually between 1980 and 1982, turned negative from 1983-85 due to this shifting locus of care. Productivity per intermediate service also improved but at a slower rate because of the large declines in inpatient volumes. Productivity improvements were greater in urban hospitals, resulting in slower cost inflation and a better financial position compared with rural hospitals. (Abstract by: Author)


OBJECTIVE--To estimate the financial effect of random yearly variations in need for services on fund holding practices with various list sizes. DESIGN--A simulation model was derived using historical data on general practitioner referrals for the 113 surgical procedures covered by the general practitioner fund, combined with data on the hospital prices for those procedures. PATIENTS--Resident population of Central Birmingham Health Authority. MAIN OUTCOME MEASURES--Expected expenditure on the relevant surgical procedures for the whole district and for practices with list sizes of 9000, 12,000, 15,000, 18,000, 21,000, or 24,000
for each of 100 simulated years. RESULTS--By using average hospital prices for the West Midlands region the mean (SD) annual expenditure for the 179,400 residents was 4,832,471 pounds (87,149 pounds); the random variation between the 5th and 95th most expensive years was 5.7% of the mean cost. For a practice with a list size of 9000 the values were 244,891 pounds (18,349 pounds), with a variation of 27.5%. With a list size of 24,000 the values were 652,762 pounds (32,512 pounds), with a variation of 15.3%. CONCLUSIONS--Random variations in need for inpatient services will have a significant financial impact on the practice fund. The problem will be particularly great for smaller practices. Additional measures are required to ensure that the scheme is not undermined and that the potential benefits are secured.


OBJECTIVES: The authors examine whether the odds of having a hospitalization associated with an ambulatory care sensitive condition can be explained by observed differences in a Medicare beneficiary's predisposing, enabling, and need characteristics.

METHODS: A multivariate cross-sectional analysis of Medicare's administrative inpatient claims data and the Medicare Current Beneficiary Survey was conducted on a nationally representative sample of Medicare beneficiaries. Each Medicare beneficiary's hospital utilization was classified into one of three categories: (1) no hospital admissions; (2) hospitalized, but no hospitalizations for a potentially preventable condition; and (3) at least one potentially preventable hospitalization.

RESULTS: The results suggest that being older, black, or living either in a core standard metropolitan statistical area (SMSA) county or a rural county significantly increases the odds of a preventable hospitalization, whereas having attended college, or having only Medicare insurance coverage reduces the odds of a preventable hospitalization. Further, those individuals who assess their health status as poor, have had coronary heart disease, a myocardial infarction, or diabetes, and required assistance with two or more of the six basic activities of daily living are at a greater risk of a preventable hospitalization.

CONCLUSIONS: Policy efforts aimed at reducing the number of preventable hospitalizations among the elderly should address the complex health care delivery needs of those Medicare beneficiaries who have special health care needs because they are very old, black, live in core SMSA or rural counties, have poor overall health status, and have physical limitations. Efforts to reduce the number of Medicare beneficiaries who experience a preventable hospitalization may be cost-effective as these beneficiaries may account for up to 17.4% of Medicare's reimbursement for inpatient, outpatient, and physician services in our data set.


Although economic evaluation in health care has a long-standing tradition in the United Kingdom, very little is known about its impact on decision making, particularly following the introduction of the internal market. Since managed competition appears to be growing in popularity worldwide, the U.K. is an interesting case study, as the reforms are well underway and there have been a number of efforts to conduct and disseminate economic evaluations. In this paper the potential for using economic evaluation in health care decision making in the U.K. is discussed. Then its actual impact is assessed in two ways. First, two case studies are discussed, on heart transplantation and the use of pharmaceuticals in the management of labour in pregnancy. Second, new data from a recent survey of potential users of economic evaluations are presented, with the emphasis on exploring the reasons for the impact, or lack of impact, of economic results. It is concluded that the NHS reforms increase the potential for the use of economic evaluation. However, there is a need to increase decision-makers' awareness of economic studies and to help them interpret study methodology and results. Although
worries about validity of economic studies are one of the major barriers to their use, other important barriers relate to the multiple objectives being pursued, of which increased efficiency is just one, and the difficulties of freeing resources from existing services in order to divert them to more cost-effective treatments and programmes.


It has been projected that over the next decade as many as 700 hospitals will close due to financial pressures created at least in part by the problem of uncompensated care. Many analysts contend that smaller, rural hospitals will be disproportionately represented among those which close. This investigation uses data collected from over 14,000 inpatient records from 130 representative hospitals in Florida to examine the degree to which rural hospitals experience an uncompensated care problem which differs in source, or magnitude, from that experienced by urban institutions. The analyses show that 150 days following the provision of service, the mean per capita outstanding amount was $18 higher for patients seen in rural hospitals than those seen in urban hospitals. Further, the odds of a rural hospital patient having some outstanding balance 150 days after service had been rendered ranged from 1.2 to 1.3 times those for patients seen in urban hospitals. The location difference is not eliminated by controlling for sociodemographic differences of the patients or the circumstances surrounding the type and/or source of admission. The single most important predictor of having outstanding hospital charges is possession of health insurance. Patients with no coverage are 38.6 times more likely to have some nonzero outstanding balance than patients with some form of insurance coverage. After controlling for sociodemographic, economic, and circumstances surrounding admission, the odds increase from 38.6 to 73.6. The critical role played by insurance is further evidenced by noting that the odds of someone with third party insurance coverage having an unresolved amount greater than or equal to $250 is only .024 and only slightly higher (.048) for government coverage. (Abstract by: Author)


This study found none of the individual studies of cost savings at the end of life associated with advance directives, hospice care or the elimination of futile care as definitive.


This paper provides an update of annual economic costs imposed by fall injuries. Such costs include medical, rehabilitation, hospital costs, and the costs of morbidity and mortality. These costs are projected to the year 2020, based on changing demographic trends. The market for slip and fall injury prevention is analyzed for the elderly and for those in the workplace-two high risk groups. Questions as to whether this market operates in a socially desirable manner, or whether government intervention is justified on efficiency grounds, are considered. Essential aspects of cost-benefit analysis are reviewed in the context of a prospective evaluation of interventions to prevent slip and fall injuries. The cost-benefit analysis framework is applied to part of the FICSIT experiment (a major intervention to reduce falls among the elderly) and to recent revisions in Occupational Safety and Health Administration regulations directed at reducing workplace falls. (Abstract by: Author)


Optimal communication between primary care physicians and consultants includes transfer of relevant clinical information, including the patient's perspectives and values, and
provides a means of collaboration to provide meaningful and health-promoting interventions. Communication difficulties arise because of lack of time, lack of clarity about the reason for referral, patient self-referral, and unclear follow-up plans. Also, primary care physicians and consultants may have different core values and may have little day-to-day contact with each other. Poor communication leads to disruptions in continuity of care, delayed diagnoses, unnecessary testing, and iatrogenic complications. Changes in the health care system offer the opportunity for improved collaboration between physicians by creating smaller administrative units within large health care systems that facilitate contact between primary care physicians and consultants; incorporation of discussions of uncertainty, patient preferences, and values into referral letters; adoption of a friendlier consultant letter format; and the improvement of the transfer of clinical data.


Disease management is a systematic population-based approach to identifying those at risk, intervening using information from the growing field of evidence-based medicine, and measuring patient outcomes once an intervention is in effect. Operationally, this is a challenging series of tasks, and vulnerability for this field. Important aspects include the development of clear clinical guidelines, agreement on the part of providers and patients to participate, sophisticated information architecture, well-designed and tested interventions and a logical measurement plan for the collection of outcomes. While there is a clear need for evidence of its benefit, the field is expanding rapidly and incorporating many other disciplines and aspects of healthcare delivery as well.


Many health services researchers point to a growing surplus of physicians by the end of the century. The author discusses in detail a variety of policy positions, from the Flexner Report onward, that have affected the present and projected supplies of US physicians. These include the American Medical Association's decades of efforts to control the numbers and types of US medical students, effects of Medicare and Medicaid; changes in immigration and naturalization laws that increased the number of international medical graduates (IMGs); the medical community's non-response to the 1981 GMENAC Report's forecasts on physician oversupply; growth in the numbers of applicants to medical schools, the changing composition of the physician workforce, the refusal of the medical profession to consider a shorter training period for physicians, and other events from the past that can inform today's policymakers. The author then evaluates four policy recommendations that have evolved to deal with the problem of physician oversupply, and concludes that (1) reliance on the market to contain physician supply is unwarranted; (2) there is little prospect that Congress will soon reduce the inflow of IMGs, and even if it did, such action would have a marginal effect; (3) there is no prospect that 20-25% of US medical schools will be closed by 2005, since the forces militating against such action are overwhelming, and (4) it remains to be seen whether the new health care environment will have more than a marginal effect in altering the current ratio of primary care to specialist physicians in the years ahead. In fact, if future outlays for health care increase as predicted, there should be sufficient funds for physician supply to continue to grow and for specialists to continue to make good incomes.


Beyond offering optimum care for individual patients, physician referrals have a cumulative economic impact on many components of the broader medical care system. This
article offers an approximation of the magnitude of that impact. By retrospectively reviewing financial records associated with 225 referrals from fee-for-service, rural family practice sites to university-based specialist colleagues, we found that the average referral generated $2944 in combined hospital charges and professional fees within a six-month period after referral. Almost half (110/225, or 49%) of those referrals resulted in a hospital admission and 72% of all revenue associated with referral accrued to the hospital. A second and more detailed study of 97 referrals showed that only 18% of total revenue resulting from referrals accrued to the physician to which the patient was initially referred. We argue that control over volume and destination of referrals, historically the referring physician's prerogative, is susceptible to change in our rapidly restructuring medical care system. In the future, no economic entity that benefits from physician referrals should take for granted those referrals or their impact. (Abstract by: Author)


OBJECTIVE. The purpose of this study is to examine the geographic scope of rural hospital markets. DATA SOURCES. The study uses 1988 Medicare patient discharge records (MedPAR) and hospital financial information (HCRIS) for all rural hospitals participating in the Medicare Program. STUDY DESIGN. Hospital-specific market areas are compared to county-based market areas using a series of geographic and socioeconomic-demographic dimensions as well as indicators of market competitiveness. The potential impact of alternative market configurations on health services research is explored by estimating a model of rural hospital closure. DATA COLLECTION/EXTRACTION METHODS. Hospital-specific market areas were defined using the zip code of patient origin. Zip code-level data were subsequently aggregated to the market level. FINDINGS. Using the county as the hospital market area results not only in the inclusion of areas from which the hospital does not draw patients but also in the exclusion of areas from which it does draw patients. The empirical estimation of a model of rural hospital closure shows that the definition of a hospital market area does not jeopardize the ability to identify major risk factors for closure. CONCLUSIONS. Market area definition may be key to identifying and monitoring populations at risk from rural hospital decisions to downsize or close their facilities. Further research into the market areas of rural hospitals that have closed would help to develop alternative, and perhaps more relevant, definitions of the population at risk. (Abstract by: Author)


In a panel of young adults, it is found that alcohol consumption is addictive in the sense that increases in past or future consumption cause current consumption to rise. The positive and significant future consumption effect is consistent with the hypothesis of rational addiction. The long-run price elasticity is approximately 60% larger than the short-run price elasticity and twice as large as the elasticity that ignores addiction. Thus, a tax hike policy to curtail consumption or abuse may not have a favorable cost-benefit ratio unless it is based on the long-run price elasticity.


The introduction of Medicare’s Prospective Payment System (PPS) has disproportionately increased financial pressures on rural hospitals and posed challenges to the survival of these institutions. Increasingly, rural hospitals are seeking strategies that can enhance their chances for survival in a turbulent and hostile environment. This study examined the survival effects of one such strategy, multihospital system affiliation. Specifically, we
assessed: (1) whether and how different types of system affiliation in the post-PPS era affect the likelihood of rural hospital survival; (2) whether particular structural, environmental and hospital performance characteristics moderate the effects of system affiliation on rural hospital survival; and (3) whether systematic selection by rural hospitals into multihospital systems potentially accounts for observed relationships between system affiliation and survival. Proportional hazards analyses indicate that system affiliation with investor-owned systems significantly reduces survival probabilities of rural hospitals. Affiliation with not-for-profit systems or system affiliation under contract management arrangements does not affect survival probabilities of rural hospitals. These general findings are moderated by the effects of hospital ownership and size at the time of affiliation. Finally, study findings indicated that systematic selection by poor performing rural hospitals into investor-owned systems has occurred in the post-PPS era. No evidence of selection into not-for-profit systems was discovered. (Abstract by: Author)


Pediatricians have a vital role in making effective mental health referrals for many children and their families. After selecting families who are appropriate for referral, for which type of resource, and the severity of their problems, the clinician should carry out a careful process to ensure the success of the referral. Special attention should be paid to finding the pain in individual family members, locating appropriate resources, and following up once a referral has been made. (Abstract by: Author)


OBJECTIVE: This study aimed to examine paediatricians’ training in and understanding of communication development and disabilities and their attitudes to speech pathology waiting lists and management practices. The relationship between these factors and referral rates was also investigated. METHODOLOGY: A total of 229 paediatricians registered with the Australian College of Paediatrics participated in the study in November 1996. They answered 15 multiple-choice questions designed to collect demographic information and data pertaining to their training and understanding of communication development and disabilities. The survey also obtained data on referral rates to public and private speech pathology services and on paediatricians’ perceptions of speech pathology waiting lists and possible management strategies. RESULTS: Referral rate to public and private speech pathology services was found to be associated with the quality of paediatricians’ training in and knowledge of communication development and disabilities. Paediatricians who had regular contact with speech pathologists were also more likely to make more referrals. Waiting lists had a negative influence on referral rate. Treatment rather than assessment waiting lists were preferred. Paediatricians believed the best solution to speech pathology waiting lists was an increase in staffing levels particularly in community health centres. Respondents reported that 1-4 months was an acceptable time to wait for speech pathology care and indicated the order of importance of factors for prioritizing children. CONCLUSIONS: The results have important implications for developing best practice models for improving referral processes and access to speech pathology services for children with communication disabilities.


OBJECTIVE: To determine whether there is regional variation in environmental (non-medical) factors affecting referral decisions of family physicians (FPs). DESIGN: Cross-sectional interview survey. SETTING: Nova Scotia. PARTICIPANTS: A random sample of 125
FPs grouped into 1 of 5 functionally defined geographic regions of Nova Scotia (25 in each group). Groupings were based on access to general hospital beds through active staff hospital appointments or to specialist consultants in the community, or both. Participants were personally interviewed on site. No physician refused an interview. In 9 cases the physician indicated that he or she did not fit the profile of the assigned group; the physician was excluded from the study and the next doctor on the list was substituted. OUTCOME MEASURES: The questionnaire was designed to test several hypotheses about factors known to potentially influence decisions about referral. Geographic differences in factors affecting referral and in decisions about 5 hypothetical cases were assessed with the use of significance tests for proportions that were sensitive to specific orders across groups. RESULTS: Three factors affecting referral showed unequivocal variation across the 5 groups. Access to hospital facilities and remoteness from specialist care, leading to local styles of practice or treatment policies, and the FP’s relationship with specialist consultants appeared to be important non-medical factors affecting referral decisions. For similar case scenarios the physicians living in rural areas would refer only half as often overall as those living in urban areas with tertiary care hospitals; for some cases, such as a severe asthma attack, the difference was more than 7-fold. CONCLUSIONS: Significant differences in non-medical factors affecting referral, and in referral decisions about hypothetical cases, were found between the groups of FPs. Differences in access to resources, creating local styles of practice, appeared to explain most of the variation. The results may account for previously observed differences in actual rates of referral for these particular groups.


Due to congressional concern that rural hospitals were particularly disadvantaged by Medicare’s Prospective Payment System, the U.S. General Accounting Office investigated the role of Medicare and other factors in hospitals’ risk of closure. This paper reports on the findings of that study, which compared the risk of closure among urban and rural hospitals during 1985 to 1988, the period after implementation of PPS. When hospital operating and environmental characteristics were held constant, the odds of closure in rural and urban areas differed significantly only for private nonprofit hospitals. Although a number of factors were associated with hospitals’ higher risk of closure, we did not find evidence that Medicare was a major factor associated with financial distress or closure during the 1985 to 1988 period. (Abstract by: Author)


A case study design was used to determine the reliance on technology assessment of decision-makers in hospitals, health maintenance organizations (HMOs), and third-party payers. Thirty different organizations were contacted and semi-structured interviews conducted. The study found that hospitals, HMOs, and insurers are conducting technology assessments, but the form and sophistication of these analyses range widely. Hospitals are particularly focused on traditional financial analyses (“prudent purchasing”) with the exception of pharmacy committees, which generally conduct more sophisticated socio-economic analyses. HMOs and insurers conduct outcome assessments for coverage of expensive or controversial technologies but exclude economics. Technology assessment will become increasingly important in resource allocation decision making and it is in the interest of technology providers to foster better information, a more comprehensive assessment process, and a more efficient assessment system. (Abstract by: Author)

This study investigates how the closure of rural hospitals affected other rural hospitals. The empirical analysis examined whether being the neighbor of a closed rural hospital affected financial performance variables during the periods before and after closure. Before and after comparisons of surviving rural hospitals were made between 1985 and 1989 for closures in 1987 and between 1986 and 1990 for closures in 1988. The regression results showed that neighbors of closed rural hospitals typically did experience increased volume in comparison to non-neighbors, but the increased volume did not lead to reductions in average cost or to improved profitability, after controlling for other factors. (Abstract by: Author)


Subsidized rural clinics and providers have long depended on the rural hospital for the care of some of their patients; the hospital has also been a source of revenue for these providers and programs. We studied a representative national sample of 116 subsidized rural clinics, focusing on the impact on rural clinic costs and revenues of the use of the hospital by the clinics’ providers. Both clinic costs and revenue are reduced by the use of the hospital by rural practice providers, but costs are lowered to a greater extent than revenues, thereby enhancing the financial self-sufficiency of the subsidized clinic. The cost savings affect all aspects of clinic operation, but especially laboratory costs, community services costs, and administrative costs. The dependence of these rural clinics on the hospital indicates that the condition of subsidized rural clinics would be worsened by decreased availability of hospital services. (Abstract by: Author)


Innovative approaches to patient management are needed to ensure that only those patients who would benefit most are referred from primary to secondary care. This report describes an exploratory study in which general practitioners adopted the role of reviewing the management of patients who would otherwise be referred to hospital. Patients in eight general practices in South Wales were referred In-house by general practitioners to a colleague in the practice who reviewed the need for hospital care. Qualitative data from interviews and questionnaires is presented. In-house referral appears to be acceptable, practical and of value to both general practitioners and patients.


Rural America desperately needs primary care physicians. Rural residents need the healthcare services that primary care physicians provide, while rural healthcare organizations need the revenue generated by referrals for specialty and acute care services. However, as managed care grows in urban areas, so does the demand for primary care physicians. As a result, large urban healthcare systems routinely offer primary care physicians alluring incentives, making rural recruitment more challenging than ever. Although Federal and state initiatives eventually may encourage more physicians to practice in rural areas, managers of rural healthcare organizations must undertake their own well-planned recruitment campaigns to fulfill current and future physician needs. Effective physician recruitment in rural areas requires commitment from hospital and community leaders, a plan for identifying candidates who are
likely to put down roots in a rural area, adequate financial and other professional incentives, and community support after a new physician arrives. (Abstract by: Author)


OBJECTIVE: To examine the current delivery of inpatient hospital services to a statewide population of rural children, define the types of pediatric conditions currently treated in rural hospitals or transferred to urban centers, and explore the role of rural pediatricians and family practitioners in the care of children in rural hospitals. DESIGN: Retrospective review of statewide hospital discharge data. SUBJECTS: All patients younger than 18 years of age with nonsurgical diagnoses discharged from both urban and rural civilian hospitals in Washington State during 1989 and 1990. RESULTS: Of 69690 pediatric hospital discharges during the study period, 16% were rural residents and 10% were from rural hospitals. Rural hospitals cared for 59% of hospitalized rural children. Marked differences were found between urban and rural hospitals in the diagnoses treated; more than two-thirds of all discharges for chemotherapy, psychiatric disorders, and neonates with multiple major problems were from urban hospitals; but the majority of the discharges for gastrointestinal diagnoses, respiratory conditions, or minor problems in the neonatal period were from rural hospitals. Rural hospitals with staff pediatricians had higher annual pediatric discharges, total charges, lengths of stay, and case mix with a higher proportion of neonates with complications, compared to hospitals without pediatricians. However, there was no evidence that these hospitals served as local referral centers for rural pediatric inpatients; the proportion of patients from outside the local hospital catchment areas was similar for rural hospitals with staff pediatricians and for those without. In rural hospitals, pediatricians and family practitioners were listed as the attending physician for 37% and 49% of discharges, respectively. The average rural pediatrician cared for five times as many inpatients as a rural family practitioner. Pediatricians cared for significantly more neonates with birth weights of less than 2500 grams, but otherwise had a similar case mix among inpatient discharges as rural family practitioners. CONCLUSIONS: Most rural children in Washington who require hospitalization for common problems receive their care in local rural hospitals staffed with pediatricians and family practitioners, although those with illnesses requiring a high level of specialty care are predominantly cared for in urban centers. Rural pediatricians make a substantial contribution to the care of rural children, especially in the area of neonatal care, although their presence in rural hospitals does not in itself create local referral centers. Inpatient volumes are higher for pediatricians, but their case mix is similar to that of rural family practitioners, except in the area of neonatology. These data support the recommendations that family practitioners contemplating rural practice receive training in general inpatient pediatrics (regardless of whether they are going to a site with pediatricians) and that pediatricians in rural practice be trained for a high volume of inpatient cases, including problems of low birth weight infants. Because systems of hospital care for rural children depend on regionalized programs, clinical and educational linkages between urban centers and rural providers should be developed and supported.


This study examines the effect of 13 strategic management activities on the financial performance of a national sample of 797 U.S. rural hospitals during the period of 1983-1988. Controlled for environment-market, geographic-region, and hospital-related variables, the results show almost no measurable effect of strategic adoption on rural hospital profitability and liquidity. Where statistically significant relationships existed, they were more often negative than positive. These findings were not expected; it was hypothesized that positive effects across a broad range of strategies would emerge, other things being equal. Discussed are possible
explanations for these findings as well as their implication for a rural health policy relying on individual rural hospital strategic adaptation to environmental change. (Abstract by: Author)


A study was conducted to evaluate the potential economic effect of referrals on managed care organizations by rural physicians to providers outside a rural county. Patient referral records and associated financial data were gathered for a three-month period. Referrals by this group of rural primary care physicians to specialists outside their rural county resulted in an average of approximately $1,100 of collected revenues per episode of care and in an average of more than $2,600 of expected payments per hospital inpatient stay. The results from this study can serve as a preliminary guide for managed care providers as they structure their services for rural settings. (Abstract by: Author)


BACKGROUND AND OBJECTIVES: A model rural clinic was established by the Quincy Family Practice Residency Program with the financial support of sponsoring local hospitals. The purpose of the study was 1) to determine the financial viability of such a model practice and 2) to determine the practice’s financial effect on the sponsoring hospitals. METHODS: The rural practice was established in a medically underserved area 30 miles from the sponsoring hospitals. A cost analysis of months 7-18 of operation was performed, including an analysis of charges generated at the sponsoring hospitals. Theoretical models of practice to enhance economic viability were explored. RESULTS: The 3,051 office visits fell short of expectations. These visits generated a net practice income of $18,596. Had the practice sought full payment for these visits instead of accepting Medicare assignments, the net income potential would have been $39,182. Growth of the practice until it reached the average size of a typical rural family practice (6,000 annual visits) would produce a net income of $67,113 with Medicare assignments and $103,578 if Medicare assignments were not accepted. Had the practice been a federally designated rural health clinic, a mid-level practitioner with physician supervision could have generated a net practice income of $53,640 for 3,051 visits or $138,863 for 6,000 visits. Referrals from the model clinic for laboratory work, radiology, and hospital admissions generated $9.17 in charges for the sponsoring hospitals for each dollar charged by the clinic. CONCLUSIONS: The financial viability of rural practices is adversely affected by the Medicare reimbursement system. Our model clinic had a positive economic effect on the sponsoring hospitals, suggesting that innovative collaborative sponsorship of such clinics may be mutually beneficial. (Abstract by: Author)


BACKGROUND: Few studies seeking to determine the causes of rural hospital closure have examined the opinions of individuals intimately involved with the closed facilities. The purpose of this research was to examine the reasons for small sole community general hospital closures from the perspective of local physicians and to compare these reasons with the perceptions of local mayors. METHODS: Hospitals in this study were selected from a list provided by the American Hospital Association. A two-page questionnaire was sent to every physician who had practiced in the towns in which a sole community general hospital had closed between 1980 and 1988. RESULTS: Physicians reported government reimbursement policies as the most important reasons for hospital closure, agreeing with the mayors’ opinions. Other reasons cited were general financial difficulties, competition from other hospitals, and bad board leadership. More than three-quarters of the physicians surveyed considered the quality of
care provided by their facilities to be average or better. CONCLUSIONS: The closure of rural hospitals that physicians consider of average or better quality suggests that many of the closed hospitals could have continued to provide valuable services to the residents of their communities. Efforts must be made to ensure that rural communities are not losing viable and useful facilities. (Abstract by: Author)


The referral process is an important means of obtaining patients and it is necessary to determine ways of influencing the referral process to increase the patient base. This article reports research based on a survey of the referral habits of 806 primary care physicians. The results are examined in the context of physician receptivity to marketer-controlled versus health services sources of referral information.


Cost-effectiveness analyses usually quantify peoples’ attitudes towards delayed outcomes using the exponential discount model. The authors examined three assumptions of this model by assessing the time preferences of individuals towards hypothetical health states and calculating implicit annual discount rates. Of a random sample of medical students, house officers, and attending physicians, 121 participated, reflecting a response rate of 81%. The participants considered three temporary events (colostomy, blindness, depression) that were destined to occur at five sequentially distant times in the future (one day, six months, one year, five years, and ten years). The utility of each prospect was measured using two elicitation techniques (standard gamble and categorical scaling), and 1,394 implicit discount rates were calculated. Of all the discount rates, 62.1% equaled zero, 10.0% were less than 0.00, and 15.7% were greater than 0.10. Mean discount rates for relatively proximal time intervals tended to be larger than those for relatively more distant intervals (0.041 vs. 0.025, p < 0.01). Mean discount rates for blindness tended to be smaller than those for colostomy or depression (0.023 vs. 0.039 vs. 0.037, respectively, p < 0.005). Hence, peoples' implicit discount rates are not always small positive numbers that are constant over time and the same for all settings. The authors suggest that the conventional exponential discount model may not fully characterize the time preferences held by individuals. (Abstract by: Author)


OBJECTIVE: Total monetized and nonmonetized costs and benefits to society of the Monroe-Livingston demonstration project's capitated payment system (CPS) were analyzed. METHODS: Total costs and benefits of care for individuals who were prerandomized to an experimental group (of whom about 57 percent were enrolled in the CPS) were compared with those for a control group who received traditional fee-for-service care. Separate two-year results are presented for continuous patients, who were enrolled in a comprehensive CPS plan (N = 201) and for intermittent patients, who were enrolled in a partial plan (N = 155). RESULTS: All groups showed improvements on many psychosocial measures over the two years. Continuous patients in the experimental group experienced less hospitalization, more case management and transportation services, and higher levels of victimization and were more likely to live in unsupervised settings than continuous patients in the control group. Total annual per patient costs for care of continuous patients ranged from $74,000 to more than $100,000, largely reflecting differences in rates of hospitalization. Experimental subjects in the partial capitation condition differed from the control group in this plan on fewer measures; both groups reported high levels of case management and social support services and relatively lower levels.
of supervised housing. **CONCLUSIONS:** The CPS resulted in major improvements in the community's services for persons with serious mental illness and reduced the proportion of care provided in the state hospital. (Abstract by: Author)


The medical and financial advantages of centralizing health services contrast with the disadvantage that they are less accessible to patients, and this is specially felt in out-patient departments. In a study based on rural Northern Ireland Norma Reid and Chris Todd looked into how patients traveled to the OPD and how long it took them. It was the socially disadvantaged—the poor, the unemployed and the retired, who did not have a family car—who were most disadvantaged by the inaccessibility of the hospital and although they were quite numerous they were probably not enough to make a commercial bus service viable. (Abstract by: Author)


Sound financial management has been identified as a critical component of effective hospital administration. Inadequate financial practices are a leading factor in the failure of hospitals. As part of the Rural Hospital Project (RHP), which operated in six rural Northwest communities from 1985 to 1988, detailed and extensive analyses of financial practices were conducted to identify strengths and weaknesses of the hospitals' financial management. In addition, 15 hours of formal education covering a variety of financial topics were presented to project participants. Results of the evaluation demonstrated that the greatest degree of change occurred in the financial management leadership capacity of the hospitals. All five hospitals, which either had no chief financial officer initially or subsequently experienced a turnover in the position, recruited individuals with strong qualifications. Vacancies in the administrator position in three of the four hospitals were filled by individuals with stronger financial management qualifications than their predecessors. Hospital board finance committees were formed in three of the four communities which previously did not have them. The biggest changes in financial practices occurred in the budgeting processes, which by 1989 better reflected the goals and strategies of the hospital's strategic plans. The financial performance of the six hospitals varied considerably over the study period. As a group, the RHP hospitals continued to require substantial nonoperating subsidies to remain solvent, despite improved financial practices. Despite the methodological limitations of this evaluation, we conclude that the intervention improved the capacity of the hospital administrations' financial leadership, as well as that of the governing boards, and led to substantial improvement in selected financial practices at all sites. Rural hospitals continue to operate in a hostile and precarious financial environment that limits their ability to sustain themselves on the basis of operating revenue alone. (Abstract by: Author)


Understanding the links between Medicare involvement and financial performance in rural hospitals is important for evaluating reimbursement policy under Medicare's prospective payment system (PPS). While simple comparisons between urban and rural hospitals suggest that the latter have lower PPS profit margins on average, there is little multivariate evidence on how Medicare involvement affects financial performance in rural hospitals and whether this relationship differs between rural and urban hospitals. Existing multivariate evidence suggests that Medicare involvement improves PPS profits in both rural and urban hospitals after controlling for other hospital- and market-specific factors. By contrast, the present analysis
considers the relationship between Medicare involvement and broader measures of profitability than PPS profits. This provides insight into whether Medicare reimbursement is adequate relative to other forms of third-party payment. The results indicate that Medicare involvement has a markedly different effect on the profitability of rural versus urban hospitals. Greater Medicare involvement is associated with lower patient care profitability in rural hospitals but has a strong positive and significant effect on both patient care and overall (i.e., patient and nonpatient) profitability in urban ones. Medicare involvement is not significantly related to overall profitability in rural hospitals, however, suggesting that these hospitals may be able to mitigate patient care revenue shortfalls from greater Medicare involvement by increasing their nonpatient care revenue sources. (Abstract by: Author)


This set of six manuscripts describes the content and impact of the WAMI Rural Hospital Project (RHP), a research and development effort supported by the W.K. Kellogg Foundation, designed to improve the delivery of health services in six rural communities in the Pacific Northwest and Alaska. The major objective of the RHP—an activity which spanned a four-year period from 1985 through 1988—was to assist the project communities in improving the financial stability and quality of care of their local health care systems. Special attention was directed at helping the communities determine and implement an appropriate scope of health services, improve management and governance of the local health care enterprise, recruit and retain additional health personnel, and increase the extent to which community residents used local health services. In this first section we discuss the historical antecedents and conceptual underpinnings of the RHP and describe the five principal phases of the project. These include: (1) selection of communities for participation in the RHP, (2) comprehensive analysis of the health care system in each community, (3) community health services planning, including the development of comprehensive strategic plans, (4) implementation of techniques to improve local health services, and (5) project dissemination and evaluation. A pre-test, post-test model was employed to assess qualitative and quantitative changes in a variety of key measures of health system performance, including organization and management, scope of services, fiscal viability of the rural hospital, and utilization and patient satisfaction with health services in each community. The results of this evaluation constitute the balance of this report. (Abstract by: Author)


The key hypothesis of the study was that hospital pharmacies under the pressure of managed care would be more likely to adopt process innovations to assure less costly and more cost-effective provision of care. We conducted a survey of 103 hospitals and analyzed secondary data on cost and staffing. Compared to the size of the reduction in length of stay, changes in the way that a day of care is delivered appear to be minor, even in areas with substantial managed care share. The vast majority of hospitals surveyed had implemented some form of therapeutic interchange and generic substitution. Most hospitals used some drug utilization guidelines, but as of mid 1995 these were not yet important management tools for hospital pharmacies. To our knowledge, ours was the first survey to investigate the link between hospital formularies and use of cost-effectiveness analysis. At most cost-effectiveness was a minor tool in pharmaceutical decision making in hospitals at present. We could determine no differences in use of such analyses by managed care market share in the hospital's market share. One impediment to the use of cost-effectiveness studies was the lack of timeliness of studies. Other stated reasons for not using cost-effectiveness analysis more
often were: lack of information on hospitalized patients and hence on the potential cost offsets accruing to the hospital: lack of independent sponsorship, and inadequate expertise in economic evaluation. (Abstract by: Author)


This paper examines the role and importance of economic appraisal of health technology in Australia, particularly those appraisals conducted under the auspices of a Federal Committee. Eight specific examples are considered: extracorporeal shock wave lithotripsy, office pathology testing, magnetic resonance imaging, cervical cancer screening, bone mineral assessment, automated implantable cardiac defibrillators, liver transplantation and extracorporeal membrane oxygenation. It was found that in most cases the appraisal influenced policy, but that it was harder to assess whether there had been changes in practice or final health outcomes. It is concluded that the roles and relationships of the various players in technology assessment need to be clear, that appropriate incentives are required if socially desirable priorities are to be achieved and that the application of economic appraisal techniques needs to be timely and relevant. (Abstract by: Author)


BACKGROUND: Should care by subspecialist physicians be more costly than care by primary care physicians? This article addresses diagnostic testing, one element of the answer to this question. METHODS: A theoretical analysis was conducted of the sequences of testing, treatment, or watchful waiting in patients with low, intermediate, or high probabilities of disease. This was followed by a reanalysis of data from a previously published study of patients with chest pain from two referral populations and two primary care populations. The study used a chest pain score as a summary measure of the number of suggestive findings. RESULTS: The analysis of sequences of testing, treatment, and watchful waiting suggests that patients with intermediate probabilities of disease are most likely to be referred. The study of patients with chest pain shows that the probability of disease for a given chest pain history score is higher in referred patients than it is in primary care patients, as is the proportion of patients with intermediate and high chest pain scores. This result is direct evidence that referral physicians get more patients with suspect but often uncertain histories. In general, the probability of disease given a particular history will be lower in primary care patients, and hence testing will be less fruitful. CONCLUSIONS: Subspecialists are more likely to see patients who represent a diagnostic puzzle and have intermediate probabilities of disease. Since patients with intermediate probabilities of disease are most likely to benefit from testing, a per capita rate of testing that is higher than in a primary care practice might be appropriate in a subspecialists practice.


OBJECTIVE: To examine the process and information used by medical directors (MDs) of private health plans to make medical coverage determinations for new medical technologies, and to assess the influence of plan characteristics on the process. DESIGN: Cross-sectional national survey. PARTICIPANTS: Two hundred thirty-one MDs at private health plans representing 66% and 72% of the US population covered by HMOs and indemnity plans, respectively. MEASUREMENTS: Actual and optimal review process, final decision authority, sources, and evidence used for technology coverage decisions. RESULTS: In 96% of plans, MDs take part in the medical policy review process for new technology. However, MDs have
final authority over coverage decisions in only 27% of plans. Indemnity plans are more likely to assert that MDs should be responsible for final decisions, odds ratio (OR) = 3.3 (95% confidence interval [95% CI] 1.4, 10). Optimal sources of information of new technology were journals, medical society statements or practice guidelines, and opinions of national experts. Actual sources of information used differed from optimal ones; local experts were used more often than is considered optimal (p < .001). For-profit plans were more likely than nonprofit plans to use national experts, OR 2.5 (95% CI 1.3, 5.0), and practice guidelines, OR 5.0 (95% CI 2.5, 10). Randomized trials (94% of MDs) meta-analyses (61%), and reviews (42%) were considered the best evidence for making coverage decisions. Barriers to making optimal decisions were lack of timely evidence on effectiveness and cost-effectiveness, not legal or regulatory issues; HMO, small, and nonprofit plans were two or three times more likely to list lack of cost-effectiveness data than their counterparts (p < .05). CONCLUSIONS: Although MDs are nearly always involved in the technology evaluation process, a minority of MDs retain final authority over coverage decisions. Evidence from strong scientific research designs is the most frequently cited basis for decisions, but there is need for more timely, rigorous scientific evidence on medical interventions. How a health plan evaluates a new medical technology for coverage varies with identifiable plan characteristics. (Abstract by: Author)


OBJECTIVES: Decisions made by private health care plans as to whether to cover new medical technology have a significant impact on access, diffusion, and costs. This study describes the variation in health plan coverage of different laser technologies and the types of considerations used in making coverage decisions for them. METHODS: In a cross-sectional national survey of medical directors at private plans, medical directors indicated current coverage of 15 different laser therapies, and then ranked the top five considerations both in favor and against recommending coverage for three of the laser therapies (angioplasty, discectomy, and photodynamic therapy). The influence of explicit clinical information and/or plan characteristics on coverage and the importance of considerations was examined through multivariate analyses (multiple logistic or linear regression analysis). RESULTS: Overall, 231 medical directors responded from plans representing 66% and 72% of persons in US health maintenance organization and indemnity plans, respectively. Current coverage for 13 of the 15 laser therapies varied between 20% and 90%. For-profit and indemnity plans covered approximately two more of the different laser technologies than nonprofit plans and health maintenance organizations. Considerations most frequently listed in favor of and against recommending coverage across the three laser technologies were clinical, economic, and regulatory. Legal, competitive, and compassionate concerns were listed less frequently. Considerations were not uniform across laser therapies; they reflected the specifics of the technology under review. Plan characteristics influenced the ranking of considerations as well. For instance, health maintenance organizations were two to three times more likely than indemnity plans to list potential for decreased cost in favor of recommending coverage. CONCLUSIONS: These findings demonstrate that there is substantial variation in coverage of new technologies, indicating that a large proportion of the population covered by private health plans are ineligible for treatments that are routinely available to others. A greater range of medical therapy may be available for persons enrolled in indemnity and for-profit plans should their physicians choose to prescribe it. Clinical and economic considerations, including cost-effectiveness, predominate in coverage decisions for new technologies. The importance of considerations appears sensitive not only to specific clinical information, however, but also to characteristics of health plans. (Abstract by: Author)

**OBJECTIVE:** To examine the dynamic effects of competition and hospital market position on rural hospital closures. **DATA SOURCE/STUDY SETTING:** Analysis of all rural community hospitals operating between 1984 and 1991, with the exception of sole-provider hospitals. Data for the study are obtained from four sources: the AHA Annual Surveys of Hospitals, the HCFA Cost Reports, the Area Resource File, and a hospital address file constructed by Geographic Inc. **DATA COLLECTION AND ANALYSIS:** Variables are merged to construct pooled, time-series observations for study hospitals. Hospital closure is specified as a function of hospital market position, market level competition, and control variables. Discrete-time logistic regressions are used to test hypotheses. **PRINCIPAL FINDINGS:** Rural hospitals operating in markets with higher density had higher risk of closure. Rural hospitals that differentiated from others in the market on the basis of geographic distance, basic services, and high-tech services had lower risks of closure. Effects of market density on closure disappeared when market position was included in the model, indicating that differentiation in markets should be taken into account when evaluating the effects of competition on rural hospital closure. **CONCLUSIONS:** Our findings suggest that rural hospitals can reduce competitive pressures through differentiation and that accurate measures of competition in geographically defined market areas are critical for understanding competitive dynamics among rural hospitals. (Abstract by: Author)


The rural hospitals in Texas face the same situation as rural hospitals throughout the country. Unfortunately, little data are available to define the scope or possible duration of the problem. However, rural hospital administrators currently believe that their facilities are being hurt by increased government regulation and that today's figures on average daily census indicate that the problem could threaten their hospital's long-term viability. Initial investigations have shown that the problem of casualty is a complex one; multiple factors interact to exacerbate the situation, such as more stringent enforcement of Medicare certification standards, review of claims and quality of care by PROs, and the use of PPS. Other factors cited include the economic recession, the exodus of young people from rural areas to urban areas, the high cost of technology, and the preadmission review by insurance companies. A study that will both sample and survey rural hospital viability using financial ratio analysis and service utilization data is presently being undertaken to provide some responses to these concerns. Further, it will later examine how rural hospital administrators are responding to the problem of decreased hospital viability. It is possible that new coping strategies may be developed from the study results that will change present modes of health care delivery and result in regional networks and more diversified health care services. (Abstract by: Author)


The authors examine whether Oregon's 1990, 1991, 1992, and 1993 prioritized lists were ranked in a manner consistent with cost-effectiveness. Two sets of cost-effectiveness data are used: data from economic analyses and Oregon's own cost-effectiveness data. Comparing the ranks of Oregon's lists with the ranks of cost-effectiveness estimates from the literature reveals Spearman correlations of -0.08 for the 1990 list, +0.39 for the 1991 list, +0.25 for the 1992 list, and +0.24 for the 1993 list. Comparing Oregon's lists with Oregon's own cost-effectiveness data reveals rank correlations of +0.99 for the 1990 list, +0.06 for the 1991 list, -0.05 for the 1992 list, and -0.03 for the 1993 list. Thus, there appear to be essentially no relationship between the 1990 list and cost-effectiveness estimates from the economic literature.
and modest positive relationships between the 1991-93 lists and the literature. In addition, there is virtually no relationship between the 1991-93 lists and Oregon's own cost-effectiveness data. Further, the correlations are very different from +1.0, suggesting that other factors are at play. For example, the 1993 list that is currently being implemented was ranked primarily by improvement in five-year survival and human judgment, not cost-effectiveness. (Abstract by: Author)


BACKGROUND: One of the promises of cost-effective analysis is that it can demonstrate how to maximize health benefits attainable within a specific limited budget. Many people argue, however, that when there are budget limitations, the use of cost-effectiveness analysis leads to health care policies that are inequitable. METHODS. We asked prospective jurors, medical ethicists, and experts in medical decision making to choose between two screening tests for a population at low risk for colon cancer. One test was more cost effective than the other but because of budget constraints was too expensive to be given to everyone in the population. With the use of the more effective test for only half the population, 1100 lives could be saved at the same cost as that of saving 1000 lives with the use of the less effective test for the entire population. RESULTS. Fifty-six percent of the prospective jurors, 53 percent of the medical ethicists, and 41 percent of the experts in medical decision making recommended offering the less effective screening test to everyone, even though 100 more lives would have been saved by offering the more expensive test to only a portion of the population. Most of the study participants justified this recommendation on the basis of equity. A smaller number stated either that it was not politically feasible to offer a test to only half the population or that the additional benefit of the more expensive test (100 more lives saved) was too small to justify offering it to only a portion of the public. CONCLUSIONS. People place greater importance on equity than is reflected by cost-effectiveness analysis. Even many experts in medical decision making -- those often responsible for conducting cost-effectiveness analyses -- expressed discomfort with some of its implications. Basing health care priorities on cost effectiveness may not be possible without incorporating explicit considerations of equity into cost-effectiveness analyses or the process used to develop health care policies on the basis of such analyses. (Abstract by: Author)


OBJECTIVE. To test whether cost-effectiveness analysis and present methods of eliciting health condition "utilities" capture the public's values for health care rationing. DESIGN. Two surveys of economics students. The first survey measured their utilities for three states of health, using either analog scale, standard gamble, or time tradeoff. The second survey measured their preferences, in paired rationing choices of the health states from the first survey and also compared with treatment of acutely fatal appendicitis. The rationing choices each subject faced were individualized according to his or her utility responses, so that the subject should have been indifferent between the two conditions in each rationing choice. RESULTS. The analog-scale elicitation method produced significantly lower utilities than the time-tradeoff and standard-gamble methods for two of the three conditions (p < 0.001). Compared with the rationing choices, all three utility-elicitation methods placed less value on the importance of saving lives and treating more severely ill people compared with less severely ill ones (p < 0.0001). The subjects' rationing choices indicated that they placed values on treating severely ill people that were tenfold to one-hundred-thousand-fold greater than would have been predicted by their utility responses. However, the subjects' rationing choices showed internal
inconsistency, as, for example, treatments that were indicated to be ten times more beneficial in one scenario were valued as one hundred times more beneficial in other scenarios.

CONCLUSIONS. The subjects soundly rejected the rationing choices derived from their utility responses. This suggests that people's answers to utility elicitations cannot be easily translated into social policy. However, person-tradeoff elicitations, like those given in our rationing survey, cannot be substituted for established methods of utility elicitation until they can be performed in ways that yield acceptable internal consistency. (Abstract by: Author)


The number of hospital closures increased substantially after the implementation of Medicare’s Prospective Payment System (PPS). This acceleration in closures raised a number of concerns over current payment policies and their impact on access. This paper investigates hospital closures that occurred in 1985 through 1988. A hospital’s financial status and mission or community standing were found to be determinants of hospital closure. Closed hospitals are much less likely to be publicly owned but more likely to offer fewer facilities and services, and have fewer cases. This may suggest that the patients directly affected by the closure can be absorbed by other hospitals or other nonhospital providers. Profitability is associated with the Medicare case-mix index and the share of Medicare patients. The findings also suggest that the case-mix index may be rewarding some small hospitals in excess of the costs attributable to case-mix. For both urban and rural hospitals, a low share of Medicare patients increased the risk of hospital closure, independently of the relationship between Medicare share and profit. The share of Medicare patients also affected closure indirectly, through its effects on profit. Competition appears to affect the odds of closure through its effects on the number of cases. In addition, hospitals in areas with small or declining population are more at risk than other hospitals in both urban and rural areas. (Abstract by: Author)


Utilization of surgical services by rural citizens is poorly understood, and few data are available about rural hospitals’ surgical market shares and their financial implications. Understanding these issues is particularly important in an era of financially stressed rural hospitals. In this study information about rural surgical providers and services was obtained through telephone interviews with administrators at Washington state’s 42 rural hospitals. The Washington State Department of Health’s Commission Hospital Abstract Recording System (CHARS) data were used to measure market shares and billed charges for rural surgical services. ZIP codes were used to assign rural residents to a hospital service area (HSA) of the nearest hospital, providing the geographic basis for market share calculations. “Total hospital expenses” from the American Hospital Association Guide were used as a proxy for hospital budget, and the surgical financial contribution was expressed as a ratio of billed surgical charges to total hospital expense. For rural hospitals as a whole, 21 percent of admissions and 43 percent of billed inpatient charges resulted from surgical services. In 1989, 27,202 rural Washington residents were hospitalized for surgery. Overall, 42 percent went to the closest rural hospital, 14 percent went to other rural hospitals, and 44 percent went to urban hospitals. The presence of surgical providers markedly increased local market shares, but a substantial proportion of basic surgical procedures bypassed available local services in favor of urban hospitals. For example, about one-third of patients needing cholecystectomies, a basic general surgery of low complexity, bypassed local hospitals with staff surgeons. (Abstract by: Author)
General Telemedicine

General Descriptive


This issue paper presents the National Rural Health Association's (NRHA) position regarding telemedicine. It does this by defining telemedicine, examining its history, exploring current applications relevant to rural communities, and then suggesting policy positions at both the national and state levels that will encourage the best use of this technology to support rural practitioners and patients. We would note at the outset, however, that telemedicine is in no sense a potential solution to the short-age of primary care providers in rural communities and should not be promoted as such.


Telepathology is entering a golden era in which both the technology and the rationale for utilizing this technology are evolving. The following decade will see the introduction of national and international telepathology networks, founded on the principle of improving patient care and increasing cost-effectiveness. As telecommunications and imaging technology concurrently advance, newer generations of telepathology platforms will ultimately deliver performance that will be essentially indistinguishable from that of microscope-derived diagnoses. (Abstract by: Author)


While the financial burdens for the receipt of health care have been substantially reduced through public and private insurance coverage, there are still large segments of the US population for whom equity of access to health care has not been fully attained. There are many people for whom time and distance constitute formidable obstacles to the receipt of care. Attention has been turned to find new ways to overcome the inequities that continue to exist, particularly in spatial access to care after financial barriers have been lessened. Telemedicine is a technological response to such problems in the delivery of health services that result from the maldistribution of medical manpower and facilities vis-a-vis the distribution of the client population. Telemedicine's immediate benefit is to bring medical services to isolated, geographically dispersed, and physically confined persons unable to reach a physician within reasonable time or distance. Indeed, its major promise for the future is to bring health services to people wherever it is not possible or feasible to bring people to health services.


Issues related to the definition and evaluation of telemedicine are articulated as a basis for conducting theoretically based empirically sound, and policy-relevant evaluation. This paper includes a proposed operational definition of telemedicine, a discussion of the role of telemedicine in the health care system, and economic analysis of telemedicine, an analysis of the basic approaches and requirements for telemedicine evaluation, and an identification of basic issues for evaluation.

Following a brief review of lessons learned from first generation telemedicine projects, an analytical framework for assessing the potential effects of telemedicine on cost, quality, and accessibility of health care is provided. It is proposed that the effects of telemedicine on cost, quality, and accessibility are interconnected, and a comprehensive assessment should incorporate all three aspects, each considered from the perspectives of clients, providers, and society. (Abstract by: Author)


A teleradiology system acquires radiographic images at one location and transmits them to one or more remote sites, where they are displayed and/or converted to hard copy. These systems often employ wide-area networks. Their goal is to provide improved radiological services at all sites on the network. Experience in the use of teleradiology systems has demonstrated the need for a laser film digitizer, an optical disk, and a high-quality display and/or laser film printer at each site. Single-site hardware purchase costs average $196,000, plus an additional 20% for yearly network services. Hardware purchased for a consultation or central referral facility approximates $344,000.


This article discusses the extension of primary pediatric services via telemedicine. It concludes with the suggestion that while producing more primary care physicians might eventually correct the imbalance of generalists and subspecialists, other solutions to the problem of providing primary care to the underserved are needed. One such solution in pediatrics is telemedicine.


The idea of telemedicine has been around for almost as long as there has been science fiction and has been in actual practice since the late 1950s. But, the recent upsurge in medical costs, combined with advances in technology, are now making telemedicine a widespread reality.


It is recognized that health care in rural communities could be improved significantly with the assistance of telehealth, the term by which the combined application of computer and telecommunications technologies to health care has come to be known. Yet in spite of its obvious potential, the telehealth literature has shown a surprising lack of growth. This paper reports an analysis which revealed that, between 1975 and 1990, few telehealth articles were catalogued by the National Library of Medicine, and suggests why this might have been the case. Following a brief discussion of the origins of telehealth, terminology, and the rural health care crisis, this overview examines the status of telehealth in terms of its main applications: telemedicine and tele-education. An analysis of the pattern of publications between 1975 and 1990 is then used to suggest why telehealth has not fulfilled its potential. Corrective measures are proposed and the paper concludes with a summary of recent telehealth initiatives.

A change in evaluation methodology, from a strictly technical approach to a more comprehensive one, would result in better and less biased decision making in connection with the introduction of information technology in health care. To reach this goal, guidelines are required for building and refining contextual frames, taking qualitative considerations into account. We used primary health care as an example. A literature search produced over 200 relevant articles, from which 76 were selected which explicitly referred to evaluation in connection with health care information systems. Text analysis allowed us to classify them into three groups. This allowed the development of a contextual frame and emphasized the human dimension as a possible problem area when using medical information systems.


Introductory information on telemedicine and its capabilities is explored. The article also highlights the changes telemedicine has elicited in doctor-patient relations, health care delivery, and reviews several telemedicine projects (Texas, Georgia, and Eastern Montana Telemedicine Projects).


The role of medical informatics in telemedicine is dependent on using the power of the computerized database to not only feed patient specific information to the health care providers, but to use the epidemiological and statistical information in the data base to improve decision making and ultimately care. The computer is also a powerful tool to facilitate standardizing and monitoring of care and when applied in continuous quality improvement methodology it can enhance the improvement process well beyond what can be done by hand. The coupling of medical informatics with telemedicine allows sophisticated medical informatics systems to be applied in low population density and remote areas. (Abstract by: Author)


This paper describes details of four scales of a questionnaire-- "Computers in Medical Care"--measuring attributes of computer use, self-reported computer knowledge, computer feature demand, and computer optimism of academic physicians. The reliability (i.e., precision, or degree to which the scale’s result is reproducible) and validity (i.e., accuracy, or degree to which the scale actually measures what it is supposed to measure) of each scale were examined by analysis of the responses of 771 full-time academic physicians across four departments at five academic medical centers in the United States. The objectives of this paper were to define the psychometric properties of the scales as the basis for a future demonstration study and, pending the results of further validity studies, to provide the questionnaire and scales to the medical informatics community as a tool for measuring the attitudes of health care providers. METHODOLOGY: The dimensionality of each scale and degree of association of each item with the attribute of interest were determined by principal components factor analysis with orthogonal varimax rotation. Weakly associated items (factor loading < .40) were deleted. The reliability of each resultant scale was computed using Cronbach’s alpha coefficient. Content validity was addressed during scale construction; construct validity was examined through factor analysis and by correlational analyses. RESULTS: Attributes of computer use, computer knowledge, and computer optimism were unidimensional, with the corresponding
scales having reliabilities of .79, .91, and .86, respectively. The computer-feature demand 
attribute differentiated into two dimensions: the first reflecting demand for high-level functionality 
with reliability of .81 and the second demand for usability with reliability of .69. There were 
significant positive correlations between computer use, computer knowledge, and computer 
optimism scale scores and respondents' hands-on computer use, computer training, and self-
reported computer sophistication. In addition, items posited on the computer knowledge scale 
to be more difficult generated significantly lower scores. CONCLUSION: The four scales of the 
questionnaire appear to measure with adequate reliability five attributes of academic physicians' 
attitudes toward computers in medical care: computer use, self-reported computer knowledge, 
demand for computer functionality, demand for computer usability, and computer optimism. 
Results of initial validity studies are positive, but further validation of the scales is needed. The 
URL of a downloadable HTML copy of the questionnaire is provided.


The examination of patients by telemedicine is currently experiencing a resurgence of 
interest, perhaps spurred by the increase in activity in managed care and major technologic 
advances. The history and recent publications show rapid change in the areas of interactive 
video and store-and-forward equipment, available communications media, and medical 
peripherals. Several existing demonstration projects serve as practical examples of the 
potential of telemedicine systems. Important research and clinical care issues and opportunities 
for constituency building await participation by primary care physicians. (Abstract by: Author)


Telemedicine and other technologies have great potential for use in the practice of 
medicine. Technology has run ahead of the regulatory community's ability to address important 
issues of use and misuse, including physician accountability, patient choice and confidentiality, 
and reimbursement. Boards must address these issues before practice via telemedicine 
becomes more widespread. If boards fail to act now, control will be ceded to courts, insurers, 
and companies having a financial stake in the proliferation of telemedicine.

Technology to Take Care of Patients.” Journal of the American Medical Informatics Association 

Telephone-Linked Care (TLC) technology has been developed and applied as an 
alternative to and a supplement for office visits as a means to deliver ambulatory care. TLC is 
used to monitor patients with chronic diseases, counsel patients on important health behaviors, 
and provide information and support to home caregivers of patients with disabling conditions. 
TLC speaks to patients over the telephone in their homes using computer-controlled digitized 
human speech. Patients use their telephone keypad to communicate. TLC conversations last 
2-15 minutes per call and take place weekly for periods of at least 3 months. The conversations 
consist of a salutation, password verification, the core clinical part, and a closing. The structure 
of the clinical part is similar for each of the application groups: chronic disease, health behavior, 
and caregiver support. The system architecture consists of linked voice and database 
components and their subcomponents. Preliminary evaluation indicates that TLC is well 
accepted by patients and their providers and can improve clinical outcomes. (Abstract by: 
Author)

The term telemedicine encompasses a wide range of telecommunications and information technologies and many clinical applications, although interactive video may be the most common medium. The first telemedicine programs were established almost 40 years ago, but the technology has grown considerably in the past decade. Despite the expansion of telemedicine, the volume of patients receiving services that use the technology remains relatively low (about 21000 in 1996). In part, this reflects the lack of a consistent coverage and payment policy and concerns about licensure, liability, and other issues. A considerable amount of federal funding has supported telemedicine in recent years, and legislators and federal, regional, and state policymakers are struggling with several crucial policy matters. Research on the effectiveness of telemedicine is somewhat limited, although the work that has been done thus far supports the hypothesis that, in general, the technology is medically effective. The cost-effectiveness of specific telemedicine applications has not yet been rigorously demonstrated. (Abstract by: Author)


Migration from space medicine toward telemedicine services is described by potential application areas in highly populated and remote areas of Europe. Special emphasis is laid upon links between mobile patient monitoring and health care in remote areas. Pilot projects are described for home (mobile) monitoring of newborn infants endangered by sudden infant death (SID) and adults suffering from sleep apnea. Health care in remote areas is described by the "TeleClinic project" which will link national nodes for telemedicine services in several European states for the mobile European citizen. Another project describes the future potential of robotics for semiautonomous ultrasound diagnostics and for real-time interaction of remote experts with diagnostics and therapy.


Change is not necessarily progress. Few physicians--and still fewer specialists--would characterize the wrenching changes occurring in health care over the past decade as progress. When is the last time you heard about a change in the provision of health care that gave providers more time, made practice more profitable, reduced paperwork, or made your life generally easier? Still thinking? So am I. Bad news of one sort or another has come in an unbroken stream for years now, or at least it seems that way. Payments to providers are continually reduced. Managed care has steadily reduced specialists' access to patients. The paperwork associated with referrals, billing, and laboratories continues to mount for most of us. (Abstract by: Author)


This paper offers a definition for, historical perspectives and current status of, and projections for the future of clinical practices that use telemedicine technology.


Italy has a tradition of experimental telemedicine, which dates back to the early 1970s. However, despite promising experience, widespread diffusion of telemedicine services has not occurred. The Ministry of Research recognized the potential of telemedicine for improving the quality of health care and reducing costs, and has launched a national plan for financing
research and training. The plan is expected to have a major impact on the organization of telemedicine research in Italy. In this paper, we describe the current situation, outline the structure of the national plan, and survey various applications in different fields, such as teleconsulting, teleradiology, and telemonitoring.


Evaluation of needs in rural communities led to the Georgia telemedicine network. The "totally distance-insensitive" system addresses cost issues, access to specialists, continuing medical education for rural practitioners, and community economies. Expectations are for the Georgia system to expand to include military applications and preventive health for school children. Potentially, telemedicine will take physicians into patients' settings to provide full environmental pictures, resulting in better care. State licensure and malpractice insurance coverage are the primary issues that telemedicine practitioners must deliberate and resolve.


Telemedicine is defined as the "delivery of health care and sharing of medical knowledge over a distance using telecommunication systems." The concept of telemedicine is not new. Beyond the use of the telephone, there were numerous attempts to develop telemedicine programs in the 1960s mostly based on interactive television. The early experience was conceptionally encouraging but suffered inadequate technology. With a few notable exceptions such as the telemetry of medical data in the space program, there was very little advancement of telemedicine in the 1970s and 1980s. Interest in telemedicine has exploded in the 1990s with the development of medical devices suited to capturing images and other data in digital electronic form and the development and installation of high speed, high bandwidth telecommunication systems around the world. Clinical applications of telemedicine are now found in virtually every specialty. Teleradiology is the most common application followed by cardiology, dermatology, psychiatry, emergency medicine, home health care, pathology, and oncology. The technological basis and the practical issues are highly variable from one clinical application to another. Teleradiology, including telemental medicine, is one of the better defined telemedicine services. Techniques have been developed for the acquisition and digitization of images, image compression, image transmission, and image interpretation. The American College of Radiology has promulgated standards for teleradiology, including the requirement for the use of high resolution 2000 x 2000 pixel workstations for the interpretation of plain films. Other elements of the standard address image annotation, patient confidentiality, workstation functionality, cathode ray tube brightness, and image compression. Teleradiology systems are now widely deployed in clinical practice. Applications include providing service from larger to smaller institutions, coverage of outpatient clinics, imaging centers, and nursing homes. Teleradiology is also being used in international applications. Unresolved issues in telemedicine include licensure, the development of standards, reimbursement for services, patient confidentiality, and telecommunications infrastructure and cost. A number of states and medical boards have instituted policies and regulations to prevent physicians who are not licensed in the respective state to provide telemedicine services. This is a major impediment to the delivery of telemedicine between states. Telemedicine, including teleradiology, is here to stay and is changing the practice of medicine dramatically. National and international communications networks are being created that enable the sharing of information and knowledge at a distance. Technological barriers are being overcome leaving organizational, legal, financial, and special interest issues as the major impediments to the further development of telemedicine and realization of its benefits. (Abstract by: Author)

This article reviews the numerous accomplishments of the National Library of Medicine from 1991-1996. It lists an assortment of telemedicine projects sponsored by the NLM and briefly discusses and evaluates the impact these have had on the medical community.


This article reviews the current status of telemedicine as it applies to the rural health care setting. It gives a listing of five current research projects investigating the application of teledermatology in the rural setting.


Telemedicine is a major new development. Having become technically and economically feasible, it deserves proper investigation. Rushing into equipment purchase, however, is almost certain to prove counterproductive. Face to face contact is fundamental to health care and enthusiasts of telemedicine should recognize that it is not as good as the real thing (and unlikely ever to be). However, constraints on time and resources will make face to face consultation increasingly expensive, and telemedicine has the potential to produce major efficiencies in the diagnostic process. The goal of current research is therefore to marry medicine with technology, capitalizing on the advantages of telemedicine and producing a robust system that delivers an acceptable service at an appropriate price. (20 Refs) (Abstract by: Author)


A part of the solution to scarce medical resources is telemedicine—a bundling of high- and low-tech equipment with distinct advantages for both rural and urban providers. Here is Part One of a two-part series on the state-of-the-art and its practical uses. (Abstract by: Author)


Telemedicine is a technology of the future, available today. Here, we describe successful telemedicine systems used across Australia and review barriers to further implementation. Greater academic and multidisciplinary involvement, as well as adequate funding, is needed for the further development and evaluation of these systems. (33 Refs) (Abstract by: Author)


Reviews the current state of telemedicine within Missouri, examining the location of proper sites, the training of teledermatologists, development of a working collaboration with local physicians, and the creation of a quality control and assurance system.
Critical Issues


Critical issues facing the development of telemedicine today are described and analyzed as dilemmas or paradoxes. The technological dilemma involves the difficult choice between using the latest technology regardless of how well it fits specific needs on the one hand, and the reluctance to capitalize on the available technological capability to create efficient and effective organizations for expanding the reach of health care on the other hand. The evaluation paradox points to the disjuncture between policy-making requirements and the scientific enterprise. This engenders the difficulty of producing scientifically valid and policy relevant results from programs that have not achieved maturity or a steady state of operation. The contextual hazards of limiting the scope of telemedicine to rural areas are discussed, as well as at the potential for creating a second tier of care for the remote and isolated populations. Finally, professional maturation is addressed as it underscores the importance of self-regulation and control.


Successful management of new, expensive technology requires the establishing of a formal process for assessing organizational needs and ranking them according to importance. This article addresses this process.


As history has shown, compromise between naysayers and proponents of telemedicine will allow society to reap the benefits while controlling the risks of new technology. (Abstract by Author)


Telemedicine emerged in the 1950's and declined during the 1970s and 1980s. Its reemergence in the 1990s generally tracks communications technological advances. Though its major applications have traditionally been confined to rural and under-served areas, telemedicine's application grows on a nearly daily basis. Broadly defined, telemedicine describes the transfer of medical data over facsimile or telephone and video conferencing. Though traditionally applied to patient care, it is increasingly being employed in the area of physician education. The Florida Medical Association's computer CME developments are one example. (Abstract by: Author)


This study examined clinical problem-solving processes in the context of a telemedical consultation, in order to verify to what extent the technological environment preserves the characteristics of medical reasoning that are known to occur in more traditional clinical settings. This study also provided an opportunity for examining certain fundamental aspects of medical reasoning about complex cases. Within a case-study design, we used a theoretical framework and qualitative methods originating from cognitive science. Expert physicians used reasoning strategies commensurate with the complexity of the case. The technological context of the telemedical consultation did not overly contrive the interaction, allowing them to use real-time problem-solving processes characterizing medical reasoning in naturalistic settings. The results
also suggest that high levels of expertise in the presence of very complex cases may elicit a particular configuration of problem-solving processes, associating certain reasoning patterns that are usually related to non-expert problem-solving with others that are typical of expertise. We believe that the evaluation of image transmission and diagnostic performance in telemedicine, as well as the determination of its indications and technological configurations, may benefit from taking into account, with the help of cognitive methodologies, the interacting problem-solving modalities that may be encountered in this context.


The number and scope of telemedicine projects and applications world-wide are growing rapidly along with exponential expansions in national and international information infrastructures and computer capabilities to support them. To track these rapid changes, the Center for Public Service Communications (CPSC) of Arlington, VA, developed the Telemedicine and Information Technologies in Health Care: Project Tracking Documentation for NASA. This document is maintained by CPSC and frequently updated. It tracks the following areas in telemedicine and health care informatics: (1) major existing Federal grant and other assistance programs and activities; (2) legislation effecting policy in these areas; (3) projects using various technologies throughout the US; and (4) telemedicine projects/interests in other nations. This paper is a survey of international (global) telemedicine activities that are outlined in that document.


Today, a rural or off-site clinic, staffed with advanced practice nurses, can interact with physicians and patients via telecommunications. Telemedicine links regional, national and international markets. This two-way, audiovisual interaction brings the specialist to the patient. (Abstract by: Author)


This paper discusses two conceptual models intended to facilitated research on the effects and effectiveness of telemedicine. The first is a conceptual framework to study the efficacy of telemedicine as a diagnostic medium. Using conditions that are carefully chosen to serve as indicators of effectiveness, we recommended the analysis of sensitivity and specificity to establish the accuracy of telemedicine in relation to conventional health care delivery. Suggested guidelines for interpretation of the results are discussed. The second model is a scheme for classification of telemedicine applications that is based on processes of care rather than on specificities or disorders. The purpose of this classification scheme is to facilitate research on such variables as costs, access, acceptability, and effects on practice patterns.


OBJECTIVES: To estimate the use of telemedicine in rural hospitals in the U.S. and to identify and describe those rural hospitals that are active in telemedicine. MATERIALS AND METHODS: Nationwide mailed survey, with telephone follow-up, to all hospitals not located in a Metropolitan Statistical Area. RESULTS: The overall response rate was 95% of all rural hospitals. Of these, 416 (17.55%) reported having telemedicine, and more than 530 more have plans to begin telemedicine programs during the next few years. Rural hospitals of all sizes and in all regions of the country are initiating telemedicine programs, but there is significant variation by region. Specifically, hospitals located in more populous rural counties near metropolitan
areas are less likely to have telemedicine than are hospitals located in less populous rural counties in more remote areas. Conservatively, more than 4000 teleconsults per month are estimated among rural hospitals nationwide in 1995, including all forms of telemedicine.

CONCLUSIONS: Telemedicine is becoming an important means of providing specialty medical services in rural areas. This screening survey generated information about the extent of telemedicine use in rural communities, but it also raised many new questions. These questions are being pursued through a detailed follow-up survey. (Abstract by: Author)


A national survey conducted for the Office of Rural Health Policy in 1995 identified 558 participants in rural telemedicine; 499 (89%) responded to a detailed follow-up survey to describe type of use. While 84% of respondents reported using interactive video, only 25% reported access to e-mail for exchange of data. The challenge to medical informatics is to connect dispersed providers, not just with videoconferencing, but also with other information-sharing methods. (Abstract by: Author)


Telemedicine is potentially an important feature of the continuum of care for the 21st century. It saves time, money, and energy for providers and patients, but is largely unreimbursed by third-party payers, and faces significant legal and attitudinal barriers. This article explores the major elements that support and hinder telemedicine as a viable option for patient care services. Barriers-reimbursement, attitudes, infrastructure, and training-must be offset by positive factors such as industry sponsorship of telemedicine equipment, positive clinical outcomes, and cost savings if implementation rates are to increase. Suggestions are made to nurse administrators who seek to pursue implementation of telemedicine technology. (47 Refs) (Abstract by: Author)


Health care is shifting from a focus on hospital-based acute care toward prevention, promotion of wellness, and maintenance of function in community and home-based facilities. Telemedicine can facilitate this shifted focus, but the bulk of the current projects emphasize academic medical center consultations to rural hospitals. Home-based projects encounter barriers of cost and inadequate infrastructure. The 1996 Telecommunications Act as implemented by the Federal Communications commission holds out significant promise to overcome these barriers, although it has serious limitations in its application to health care providers. Health care advocates must work actively on the federal, state, and local public and private sector levels to address these shortcomings and develop cost effective partnerships with other community-based organizations to build network links to facilitate telemedicine-generated services to the home, where the majority of health care decisions are made.


This article presents a review of issues and challenges in telemedicine from a legislative/policy perspective.

Telemedicine--the delivery of health care services to the underserved through communications technologies--has the potential to bring medical care to remote areas where health care is either inadequate or nonexistent. Telemedicine can be something as simple as a phone call, a network transmission of a radiograph or other diagnostic image, or, much more advanced, real-time video surgical consultations from anywhere on the globe. Telemedicine programs operate throughout Europe, Japan, and Australia. International programs, for profit and nonprofit, serve Asia, Africa, and the Middle East. The United States is also a major telemedicine developer, principally through government agencies such as the Department of Defense and the Office of Rural Health Policy, and, to a lesser extent, the private sector. But telemedicine in the United States has yet to prove itself economically viable, and it faces a number of political and regulatory barriers. Even more significantly, telemedicine's potential to increase overall health care spending by increasing access to health care has deterred private industry from investing heavily in it. In the short term, telemedicine's most important contribution to health care may be raising fundamental questions about United States health care policy. (Abstract by: Author)


Telecommunications from telephone and radio to two-way audio, video, facsimile (fax), and digital imaging via satellite transmission have been used in responses to disasters. Current and rapidly emerging communications technology offers the prospect of enormously expanded and more efficient application in predisaster, acute, and postdisaster rehabilitation activities. A survey of present and potential roles for telemedicine in disaster medicine will be presented with particular focus on initial on-going medical needs assessment, prevention programs, and emergency assistance for provision of emergency care of victims, care for other survivors, and public health and sanitation services. Attention will also focus on telemedicine in education and training, disaster response exercises, development of comprehensive plans, and research. Finally, the essential relationship between the routine utilization of telemedicine in predisaster health care and effective employment in disaster situations will be discussed.


Despite a large number of telemedicine trials, little information has been published on its economic costs and benefits. Most telemedicine initiatives have been funded as special projects, which were not subject to normal budgeting procedures. A framework is needed to enable decision makers in health-care delivery to analyze the potential effects of telemedicine applications on the activities, functions and roles of the different parties involved, such as hospitals, consultants, general practitioners, nurses and other health-care workers, and the different costs and benefits for each of these groups. In many countries, telemedicine projects have been introduced within special closed groups, such as in prisons, for military or space operations, or in disaster zones. However, some commercial services providing international telemedicine have also begun. Telemedicine costs are strongly related to patient volumes, but issues such as protocols for reimbursement need to be resolved before large-scale implementation is likely to be achieved.


This writing is comprised of an introduction (I.) and four additional sections: section II presents a factual background of telemedicine and the rural health care crisis; section III
examines Congress' failure to increase the supply of physicians by analyzing Congress' rural buying power definition of the problem and the subsidy approach solution; section IV explores the arguments for and against increased congressional utilization of telemedicine to address rural health care shortages; section V concludes that telemedicine can effectively overcome some rural health care barriers that Congress is not currently addressing and should be used in conjunction with current congressional efforts.


According to a recent report by the Office of Technology Assessment (1994), the cost-effectiveness of no class of medical technologies has been “adequately evaluated.” In the presence of such uncertainty, experience or technical progress leading to fewer short-term complications makes it a consideration for an increasing range of patients who remain uncertain about benefits.


This paper describes the economic issues associated with the introduction of telemedicine systems and the main challenges to their evaluation. An approach to the economic evaluation of telemedicine is described based on a cost-consequence framework. The paper links these costs and consequences more formally within a set of evaluative questions which in turn forms the basis for an economic model for evaluating telemedicine. By outlining the key questions, a number of issues relevant to the evaluation of telemedicine are identified and considered. The main challenges to the economic evaluation of telemedicine include: constantly changing technology; lack of appropriate study design to manage the frequently inadequate sample sizes; inappropriateness of the conventional techniques of economic evaluation; and the valuation of health and non-health outcomes. The present study addresses these challenges and suggests ways of advancing the techniques for the economic evaluation of telemedicine.


Telemedicine has been talked about for more than 20 years, without it entering daily use with any success. Based on transaction costs economics, the present analysis of the exchange relationships between health care producers highlights certain characteristics of the current technical and legislative context, which leads to transaction costs. It also demonstrates that the introduction of telemedicine shifts the costs associated with agents' opportunism from patients to health-care producers themselves. All these costs may be considered nowadays to thwart the use of telemedicine. It is argued here that the Public Authorities and professionals of health care could act upon telemedicine in two fields: (1) intervention in the institutional environment aims notably at better defining the property rights of telemedicine, and so constitutes an unavoidable means of encouraging health-care producers to invest in new technology; and (2) implementation of organizational forms and mechanisms susceptible to regulating such telemedical relationships between health care producers-given the present institutional environment-constitutes an essential means for overcoming the immediate barriers blocking the diffusion of telemedicine. (Abstract by: Author)

Evaluating telemedicine systems and services is a complex task. Safety and efficacy must be measured in a relatively controlled laboratory environment, while measurement of clinical utility and medical effectiveness requires extensive field testing. The need for large clinical trials to demonstrate utility and effectiveness presents a dilemma. Substantial numbers of cases are needed to achieve statistically valid results, yet most telemedicine programs are based in rural settings with small patient populations. One potential solution is to pool data from multiple programs by using common data collection instruments and protocols. A promising model for the performance of multi-centered collaborative telemedicine research is described. The Clinical Telemedicine Cooperative Group (CTCG) is based on the successful use of collaborative research by clinical oncology research groups such as the Southwest Oncology Group (SWOG). (Abstract by: Author)


Rural communities have chronically suffered from a lack of adequate care resources. Too few primary care practitioners and the need to travel long distances for specialty care have made it difficult for many rural residents to receive the care they need when they need it. Telemedicine provides one tool for improving this situation. As is often the case, however, telemedicine's potential has not been realized in rural America. Significant technical, regulatory, organizational, and financial barriers have prevented rural communities from benefiting from the technology. This paper discusses these issues and suggests a prescription for establishing successful rural telemedicine programs.


While there are significant technical and regulatory barriers to developing an adequate infrastructure for telemedicine, even more fundamental organizational and financial infrastructure issues must be addressed if this technology is to realize its potential. The lack of good evaluative data on telemedicine consultations has been a further major stumbling block to its acceptance by both practitioners and policy makers. This paper discusses these issues and suggests approaches for overcoming many of the impediments to telemedicine.


Economic evaluation of telemedicine compares the costs and other consequences of delivering specific services through telemedicine vs. alternative means. Cost-effectiveness analysis, the most common method used for health issues, helps to assess whether the expected health benefits are worth the investment. Telemedicine raises particular challenges for evaluators: a telemedicine system may have multiple uses and joint costs that are difficult to apportion to one service, the existence of a system may lead to expanded implications for use, and technological change may rapidly make an evaluation outdated. Public and private regulations and payment may affect the distribution of telemedicine. Uncertainty surrounds the policy of the U.S. Food and Drug Administration, which is still formulating its position. Changes are underway in policies on licensure and credentialing of clinicians, which have traditionally been done by state and by site, to reflect the fact that telemedicine services has been considered an impediment to adoption with fee-for-service payment. Under capitation payment and fixed budgets, however, providers have financial incentives to use the most efficient method to deliver services, and these arrangements would favor telemedicine if it is the less costly
alternative. If telemedicine were more costly and the health benefits worth the cost, monitoring might be needed to ensure quality of care. (Abstract by: Author)

Policy and Regulation


This proposed rule would implement parts of section 4206 of the Balanced Budget Act of 1997 by amending our regulations to provide for payment for professional consultation by a physician and certain other practitioners via interactive telecommunication systems. Payment may be made if the physician or other practitioner is furnishing a service for which payment may be made under Medicare to a beneficiary residing in a rural area that is designated as a health professional shortage area. This proposed rule would also establish a methodology for determining the amount of payments made for the consultation. (Abstract by: Author)


The new federalism is now taking hold in Washington, with far-reaching implications for the role of the federal government in health, education, and welfare programs; financial support for such programs; and the shift of control to the states. For telemedicine, the implications of these changes include having to make do with less external financial support and a need to establish partnerships between state and local governments, public sector developers and vendors, third-party payers, and community-based telemedicine programs. The long-term challenge for telemedicine programs, particularly in rural, medically underserved areas, is likely to be their sustainability in an adverse financial environment. The problem is further compounded by the lack of reimbursement for teleconsultations. (Abstract by: Author)


Discusses the framework and structure of telemedicine, as it should apply to Federal initiation and participation in such programs.


The missing link in substantiating the value of telemedicine in healthcare is evidence that it provides economic value and will not boost operating costs over the long term. With most telemedicine networks still in the implementation or demo phase, obtaining measurable data may not be feasible for at least a year or two. A further complication is that telemedicine has had no chance to prove itself in a fair environment, given the legal and financial barriers it faces.


Many hospitals today struggle to remain competitive through the adoption of medical terminology or expansion of hospital services. This article presents a case study of one hospital's attempt to remain viable through the adoption of telemedicine. Through the 17-year analysis of local hospital-related news reports, it is argued that a hospital's relationship to the local community can affect the success and potential of such innovations. Establishing a pattern of trust and support between the local community and hospital should therefore be an important step in increasing hospital viability. (Abstract by: Author)
Applications To Telemedicine

Satisfaction and Acceptance


Objective: To assess levels of satisfaction among rural cancer patients being seen for clinic visits by their remote university-based oncologist, using interactive videoconferencing (IAVC). Methods: A 12-item survey instrument assessing satisfaction with the patient-physician clinical interaction was administered to 39 cancer patients who were seen using IAVC. A similar survey, comprised of 9 of the 12 items used in the initial survey, was administered to 21 of these patients after a subsequent on-site clinical interaction. All items were responded to on a five-point Likert scale. Levels of satisfaction with the two consultation modes (IAVC mediated and on-site) were compared.


During the winter of 1993, medical oncologists from an urban, university-based hospital provided oncology care to rural patients using interactive video clinics (tele-oncology). In order to assess physician satisfaction with this form of outreach, surveys were performed after the video encounters, as well as after a limited number of subsequent clinical encounters on site. Various aspects of satisfaction were evaluated. Although the sample was small (a total of 41 clinical encounters and 3 oncologists), the results suggested that there was a reasonable level of physician satisfaction with, and confidence in, the use of video to replace some on-site oncology consultation. A definitive study of tele-oncology for providing care to rural cancer patients therefore appears to be warranted.


The use of telecommunications technology, telemedicine, to redress problems in the distribution and utilization of medical manpower and facilities is analyzed from the perspective of the general public and the users in a rural community. Reluctance of the public to give up the more traditional face-to-face contact with a physician is suggested by the data, but equally important is a rural population’s willingness to embark on the new technology if it does not mean total abandonment of traditional arrangements. The user data reveal that familiarity breeds comfort with the technology and that planners of these systems should always seriously consider the manpower and organizational configurations as crucial to the success of these systems.


As groups of physicians continue to provide more of their activities in sites remote from the central office, communication among providers and staff and the provision of common educational activities are important priorities. An analysis of a 12-month period of the use of full-motion interactive video technology to accomplish these goals in a decentralized academic department shows this method to be acceptable and cost-effective. Careful attention to room environment and staff support were found to be important. Practical recommendations are provided for those considering the use of this technology. (Abstract by: Author)

The utilization of a low-bandwidth telemedicine system for emergency and for home-care was studied in a pilot trial. The emergency setting was the emergency department of a small urban hospital and its emergency medical service (EMS); the home-care setting was the home-health agency affiliated to the hospital. Utilization data were obtained through baseline and follow-up interviews with EMS technicians, emergency department and home-health nurses, and the project coordinator. The results indicated that initial enthusiasm for the use of the telemedicine system was not followed by a commitment to the system's utilization during the trial by the relevant administrations. Barriers to optimum utilization were identified, but the actual value of the system to patient care could not be determined. We conclude that the value of a telemedicine system to patient care cannot be realized unless there is an organizational commitment from the top to system utilization. (Abstract by: Author)


A sociological study was made of patient experiences of telemedicine specialist consultations in northern Norway. Compared with an ordinary medical consultation, a telemedical consultation represented a wider interaction system, with more channels for access, inspection and information, which gave the patients different options for participation in the consultation.


OBJECTIVE: To compare physician and patient impressions and interphysician diagnostic agreement between live teledermatology and in-person examinations. DESIGN: Paired video and in-person examinations with different dermatologists. SETTING: An urban Veterans Affairs dermatology clinic. PATIENTS: One hundred thirty-nine patients. MAIN OUTCOME MEASURES: Satisfaction questionnaires and interphysician diagnostic agreement. RESULTS: Patient and physician satisfaction was high. Agreement between video and in-person diagnoses was 80%. CONCLUSIONS: Physicians and patients were satisfied with teledermatology examinations. Diagnostic agreement between in-person and video dermatologists was high. (Abstract by: Author)


In one practice with 14,000 patients an advice line was set aside at designated times to enable patients to speak directly to a doctor on the telephone. The aim of this study was to determine who used the line, why they called, the conditions callers presented with, the action taken by the doctor and whether patients and doctors thought the service was a good idea. A total of 277 calls were made during the five-month study period. Responses to a questionnaire were received from doctors for all 277 calls and from 152 patients. It was found that most calls lasted about three minutes. The doctor taking the call knew most of the callers (59%). Users of the advice line were most likely to be women, married, and people with children. Equal numbers of calls were received about new and existing problems. The most frequent reason for calling was to obtain the result of a test (21% of calls). The most frequent diagnosis by the doctors was chronic complaints for which the patient was already receiving treatment (19%). The data from patients and doctors were similar. In 30% of cases callers were advised to take medicine, mostly a prescription to be collected (16%), while a few callers received a home visit (7%). Doctors thought they provided reassurance in 26% of cases while patients thought they
provided reassurance in 43% of cases. If the advice line had not been available three quarters of the respondents would have made an appointment and 13% would have asked the doctor to make a home visit. The majority of respondents (65%) said they would not have preferred a face-to-face consultation to the advice line. The vast majority of respondents (91%) were satisfied with their use of the advice line. The doctors were less happy with the calls, but regarded 64% as useful. It can be concluded that telephone advice service would be a useful and worthwhile addition to the services provided by a service.


An exploratory study of 268 nurses and their practice patterns has yielded a new dimension of work excitement--computer use. The convenience sample included staff nurses and clinical nurse managers. In this article, individual and organizational characteristics of nurses, their varying computer skills, and levels of work excitement are compared. Using the work excitement tool developed through the Practice Excitement Project, data were collected on self-perceived level of computer skill and work excitement; practice patterns; interest in work; exciting and frustrating experiences when using the computer at work; and overall exciting and frustrating aspects of nursing. Pairwise comparisons revealed that nurses who classify themselves as having expert skills had significantly higher levels of work excitement than nurses who were novices (F = 5.937, p < 0.05), or had no experience with the computer (F = 7.026, p < 0.01). Nurses with intermediate skills also had significantly higher levels of work excitement than novices (F = 5.289, p < 0.05), or non users (F = 5.740, p < 0.05). Computer users were found to be significantly less negative about their work. In addition, nurses overwhelmingly considered the computer a nursing technology capable of making their work easier. This reflects the positive orientation nurses have toward use of computers in nursing. The findings further suggest that the introduction of computers could not only improve unit morale but could also stimulate the learning of new skills related to effective and quality care delivery. (Abstract by: Author)


AIM: An interactive telemedicine service has been established between Taumarunui Hospital and the Department of Dermatology at Waikato Hospital. The first one hundred dermatological consultations were reviewed to see if the consultations were satisfactory for medical staff and patients. METHODS: A proprietary video conferencing system communicating via the Integrated Systems Digital Network was used to conduct dermatological consultations. Data were collected regarding waiting time, diagnosis and follow-up arrangements. Each patient was asked to complete a questionnaire after the consultation. RESULTS: Of these consultations, 83 were newly referred patients and the rest were follow-ups. The median waiting time for a new patient was 63 days. A variety of skin lesions (in 40 patients), inflammatory eruptions (31) and infections (13) were diagnosed and managed. Sixteen patients had to be seen at the base hospital for surgical treatment (7), face-to-face diagnosis (3), patch testing (3), a second opinion (2), or for personal reasons (1). The others were followed up locally. Savings in time and cost to patients were noted particularly. CONCLUSION: Only about 20% of consultations with new patients resulted in a further face-to-face appointment. The majority of patients found the telelink acceptable. The data supported the continuation and possible expansion of the dermatology telemedicine service. However, improved image quality is desirable. (Abstract by: Author)

The purpose of our study was to investigate knowledge of, attitudes to, and use of interactive telemedicine for specialist consultation among rural practitioners Kansas. We interviewed 28 rural primary-care practitioners at seven remote health-care facilities in six locations. Content analyses of the interviews showed universal but superficial knowledge of telemedicine, appreciation of the value of the technology, but relatively low usage of the telemedicine service available (32% of subjects). Physicians did not appear to be afraid of change. Telemedicine usage was not related to the professional characteristics of the physicians. Our findings suggest that further growth in the use of telemedicine will depend on efforts directed towards physicians which are aimed at creating a more user-friendly environment and at accommodating the referral practices of potential users. (Abstract by: Author)

Outcomes


The reproducibility and accuracy of routine echocardiographic measurements by an inexperienced doctor using tele-instructions were evaluated. Thirty-eight patients were first examined at a local hospital by an inexperienced doctor instructed by a specialist 450 km away at a university hospital. The specialist then examined the patients at the local hospital using the same equipment, after an average of 50 days. The accuracy of M-mode and quantitative Doppler measurements was comparable to that observed in reproducibility studies made under normal examination conditions. There were no systematic measurement errors. No important M-mode information was missed except evidence of left ventricular hypertrophy in six patients. In the two dimensional examination there were differences of clinical significance in only three patients. There were no clinically important differences in the Doppler quantification of mitral and aortic regurgitation. Tele-instructed echocardiography is also an excellent educational tool, allowing an inexperienced examiner gradually to take responsibility for the local echocardiographic service.


A computerized system capable of transmitting digitally formatted images of the central nervous system has been used to develop a neurosurgical wide-area network in western Pennsylvania. This system links remote or primary care hospitals with a large, tertiary-care Level 1 trauma center for the constant availability of neurosurgical evaluation by receiving and interpreting computed tomography and magnetic resonance images sent via ordinary public telephone lines. This network has been used in over 20 cases to receive and interpret transmitted cranial computed abscess, cerebrovascular accident, and normal studies. There has been no known instance of false-positive or false-negative interpretation or of a patient being adversely managed by this method. On the contrary, it appears that patient management has been positively affected through the ability of the neurosurgical evaluation to include a review of the radiological studies. The initial experience has led to the conclusion that the network is an effective, accurate, and cost effective means of delivering neurosurgical care to the underserved areas.

OBJECTIVE: To evaluate a personal-computer-based teleradiology system for the interpretation of radiologic studies from an isolated community. METHODS: During a 5-month study period, 240 radiologic studies from the Grand Manan Hospital, Grand Manan, NB, were digitized and transmitted via telephone lines to the Saint John Regional Hospital, NB, for interpretation. The first 110 cases were interpreted with the use of a 1 K x 1 K monitor, and the remaining cases were interpreted with a 2 K x 2 K monitor. The teleradiology image reports were compared with the plain film reports for each case and discrepancies were identified. A panel reviewed all clinically significant discrepant cases to determine the source of the discrepancy. RESULTS: There was 90.9% concordance between the teleradiology and plain film reports in the studies interpreted with the 1 K x 1 K monitor and a 88.4% concordance in the studies interpreted with the 2 K x 2 K monitor. Only 1.7% (4/240) of the discrepancies were attributed to an inadequate teleradiology digital image. CONCLUSION: A personal-computer-based teleradiology system can be used to provide diagnostic imaging service of high quality to an isolated community. (Abstract by: Author)


The Telecar (tele-assistance cardiology) project was an example of the tele-assistance between health centres of the Regione Lazio in Italy. The project was supported by the Ministry of Health, financed with 500,000,000 lire and carried out by an operative station within 'La Sapienza' University (Rome). About 40 of the health centres in Lazio that did not have cardiologists or electrocardiography (ECG) equipment were provided with telematic instruments (cardiophone and fax). With this equipment, they were able to transmit ECG signals and receive copies of ECG reports. The 40 health centres included first-aid clinics, 'guardia medica' surgeries and community centres. The project was carried out between 1989 and 1992. During these three years, the health centres transmitted a total of 4,807 ECGs, 2,057 (43%) of which were routine; the remaining 2,750 (57%) being suspected emergencies. Of the suspected emergencies, 681 cases (25%) had a confirmed abnormality. We can confirm that telematic aids are very important for an operative station, where all kinds of emergencies must be dealt with.


This article presents the findings of one application of telemedicine, fax electrocardiogram, as it was used in a university hospital.


From April 1992 to January 1993, radiology expert opinion for MRI procedures was offered by means of teleradiology. The experiment was carried out in addition to an existing service of a mobile MRI unit. MRI images were sent by means of teleradiology on a regular telephone line from the mobile MRI unit to an academic hospital, which served as expert consultation centre. During this period, 43 requests for expert opinions were performed. This article describes the clinical effects of these expert opinions, and a technical and organizational requirements to perform teleradiology in daily clinical practice.

Teleotolaryngology is becoming a reality as a result of improvements in technology and telecommunications. This prospective, clinical trial was designed to demonstrate the utility of three telemedicine systems in an otolaryngology practice. Optel is a desktop system used in the office. Picasso is a mobile system used from various locations throughout the hospital. The Georgia Statewide Telemedicine Program (GSTP) is a large, sophisticated system used from a fixed site within a rural hospital. Patients with a wide variety of ear, nose, and throat problems were presented to consultants at two medical teaching centers in Georgia. Fifty-four consults were completed over a 24-month period. In addition, three teleconsultations demonstrated enhanced capabilities for continuing medical education (CME) and health care networks. Nine different specialty fields were accessed by the otolaryngologist. Five consults were completed via the Optel system; 13 via the Picasso system; and 36 via GSTP. Overall, teleotolaryngology provided quality audio and visual communication between the physicians that significantly improved diagnostic capabilities and treatment options for the patient. (Abstract by: Author)


**BACKGROUND:** There is conflicting evidence about whether telephone consultations in general practice represent additional or alternative contacts with the general practitioner. **AIM:** A study set out to assess the characteristics of patients using the telephone to consult the general practitioner and whether telephone consultations were used as an additional or an alternative service to surgery consultations during surgery hours. **METHOD:** The study took place in one practice that has run a ‘phone-in clinic’ for five years. A questionnaire on perceptions of and attitudes towards telephone consultations was sent to 259 patients who consulted the general practitioner by telephone and to an age-sex matched group of patients whose medical records indicated that they had never consulted the general practitioner by telephone. For both groups, numbers of repeat prescriptions and consultations in the preceding year were determined from medical records. **RESULTS:** Those who consulted the doctor by telephone were significantly more likely to be aware of the phone-in clinic, to have a telephone at home, to have children aged under five years at home and to be receiving repeat prescriptions and repeat prescriptions for psychotropic drugs compared with those who had never consulted by telephone. Eleven of 226 patients who consulted by telephone (5%) indicated that they would definitely not have made a surgery appointment or home visit request (that is, they represented additional general practitioner workload) while 120 (53%) used the telephone consultation as an alternative to making a surgery appointment and 22 (10%) used the telephone consultation as an alternative to requesting a home visit. **CONCLUSION:** It appears that the telephone service was being used largely as an alternative access point to the doctor. General practitioners should not be apprehensive about the possible increase in workload generated by introducing telephone consultations, for example in phone-in clinics. (Abstract by: Author)


Active telepsychiatry services in the US were surveyed. Telepsychiatry was being used in four broad areas: educational, administrative, research, and clinical. Of the five telepsychiatry sites with accurate patient contact data, there was a mean of 1.35 patient contacts per week. The majority of telepsychiatry usage involved direct physician-patient contact. No adverse outcomes to patients were reported.

Telepsychiatry is the use of telecommunications technology to connect patients and health care providers, permitting effective diagnosis, education, treatment, consultation, transfer of medical data, research, and other health care activities. Telepsychiatry has been used as a partial solution to the problem of limited psychiatric services for clinics and hospitals in remote areas of areas underserved by psychiatrists and other mental health care specialists. In the United States, eastern Oregon's RodeoNet telepsychiatry program and the telemedicine program of the Kansas University Medical Center, which has a psychiatric component, are excellent models. Telepsychiatric applications can be cost-effective, but careful evaluation is needed. (Abstract by: Author)


PURPOSE: Telepresence surgery is a novel technology that will allow procedures to be performed on a patient at locations that are physically remote from the operating surgeon. This new method provides the sensory illusion that the surgeon's hands are in direct contact with the patient. We studied the feasibility of the use of telepresence surgery to perform basic operations in vascular surgery, including tissue dissection, vessel manipulation, and suturing. METHODS: A prototype telepresence surgery system with bimanual force-reflective manipulators, interchangeable surgical instruments, and stereoscopic video input was used. Arteriotomies created ex vivo in segments of bovine aortae or in vivo in femoral arteries of anesthetized swine were closed with telepresence surgery or by conventional techniques. Time required, technical quality (patency, integrity of suture line), and subjective difficulty were compared for the two methods. RESULTS: All attempted procedures were successfully completed with telepresence surgery. Arteriotomy closures were completed in 192+/-24 sec with conventional techniques and 483+/-118 sec with telepresence surgery, but the precision attained with telepresence surgery was equal to that of conventional techniques. Telepresence surgery was described as intuitive and natural by the surgeons who used the system. CONCLUSIONS: Blood-vessel manipulation and suturing with telepresence surgery are feasible. Further instrument development (to increase degrees of freedom) is required to achieve operating times comparable to conventional open surgery, but the system has great potential to extend the expertise of vascular surgeons to locations where specialty care is currently unavailable.


Availability of advanced cardiac diagnostic procedures has proven to decrease the morbidity and mortality associated with common cardiovascular diseases. It was requested that the University of Nebraska Medical Center (UNMC) provide a rural hospital with advanced cardiology services. The services included monitoring of inpatients and rapid interpretation of cardiac diagnostic tests. UNMC proposed to solve this problem by building a computer-based system to transmit diagnostic cardiac information from a rural hospital to UNMC for interpretation by a cardiologist. The information transmitted to UNMC was grouped into two categories: 1) cardiovascular ultrasound, 2) ambulatory and 12-lead electrocardiograms. The information consisted of digital and analog waveform information, static images, and 30 fps video. The system provided rapid data transmission to UNMC over a T-1 line. The system utilized a compression technology, which did not degrade the interpretation quality of the data. This system has increased the availability of advanced cardiac diagnostic services to general medical practitioners in a rural hospital. In addition, the system has significantly reduced the time and cost to transmit vital cardiac diagnostic information, thus improving the quality of care received by rural patients.

To determine whether telemedicine could assist in the earlier diagnosis of neonates with congenital heart disease (CHD) in an area hospital remote from a paediatric cardiologist, we established a low-cost telemedicine link between the neonatal unit of a district general hospital and the regional paediatric cardiology unit. Real-time ultrasound images of babies suspected of having CHD were obtained by a paediatrician and transmitted for real-time interpretation by a paediatric cardiologist. In a four-month pilot study, 10 neonates were studied in this way. In eight of the ten cases, the diagnosis made over the telemedicine link was confirmed subsequently in a direct examination of the regional unit. In one case, the patient died before the direct examination was possible. In one case, two small muscular ventricular septal defects were missed on the remote examination. Our early experience suggests that, with real-time guidance by a paediatric cardiologist, transmitted images of sufficient quality to allow confirmation or exclusion of major cardiac defects can be obtained. This form of remote consultation should improve morbidity and mortality rates by reducing the waiting time for specialist diagnosis and treatment.


PURPOSE: We evaluated the feasibility of "telesurgical" consultation during laparoscopic surgery. Telesurgical consultation is a distinct application of telemedicine in which a surgeon at a primary operating site can consult another experienced surgeon or colleague for complex and/or unexpected problems encountered during surgery. MATERIALS AND METHODS: Telesurgical consultation was used in 6 complex laparoscopic cases, including upper pole nephrectomy, diagnostic laparoscopy with inguinal hernia repair, orchectomy, gastric augmentation with bladder suspension, bladder reconstruction and ureteral lithotomy. RESULTS: In each case an experienced laparoscopic surgeon at the primary operative site consulted a surgical specialist at the remote site who had expertise in the particular procedure being performed. All procedures were accomplished successfully without intraoperative or post-operative complications. CONCLUSIONS: Complex laparoscopic procedures that normally require a surgical specialist can be performed successfully by an experienced laparoscopic surgeon consulting a remote specialist via the tele-operative system. (Abstract by: Author)


Applications of interactive video communications for providing remote telemedicine consultations are under study. Most of these applications use "off the shelf" medical peripheral devices that are not specifically designed for telemedicine examinations. This study reports a field trial of the telemedicine instrument pack (TIP), a small self-contained unit under development by the National Aeronautics and Space Administration for use in space flight. Patients with otorhinolaryngology problems were selected from a primary care practice and examined with the TIP by a technician under the direction of a remote consultant. The equipment proved adequate for examination of the posterior nose, hypopharynx, and larynx. Examinations of the ear and oropharynx with the TIP were not optimal, suggesting a need for further modifications of this prototype unit. (Abstract by: Author)

Twenty consecutive cases of melanocytic lesions were chosen from the archives of the institute of Anatomic Pathology at Santa Chiara Hospital, Trento. Representative images were acquired at a spatial resolution of 512 x 512 pixels, saved in JPEG format and delivered to the remote pathologist by multimedia internet electronic mail. Six cases were diagnosed as benign melanocytic lesions by the local pathologist. Of the 20 cases transmitted, each with an average of 5.3 images, the remote pathologist suggested a diagnosis of malignancy in nine cases while 10 cases were thought to be benign. In one case the images were not considered sufficient for diagnosis. Overall, the diagnostic agreement between local and remote pathologist was 79% (kappa = 0.58, P = 0.002). This preliminary study suggest that telepathology by internet electronic mail can be a valuable tool for remote consultation in dermatopathology, as well as for other diagnostic fields where expert consultation is necessary. (Abstract by: Author)


Although there are increasing numbers of telemedicine programs in the US, few have offered tele-oncology services, so that the role of telemedicine in the practice of clinical oncology has yet to be fully defined. Telemedicine has been used successfully for direct patient care in Kansas. It is also a method of providing supportive care for the cancer patient, including assessments of pain and nutrition. In addition, televised tumor conferences and nursing education courses can help smaller communities develop a level of expertise that allows patients to be treated locally. Telemedicine may well be used in future for access to national and international cancer experts, and for participation in new cancer treatment protocols through cooperative group trials. When practising oncology via telemedicine, there are unique problems, including issues regarding technology (interactive video and radiograph review) and practice (patient/oncologist preferences and doctor-patient communication). Very little has been published in the area of the tele-oncology so far, and studies concerning its efficacy, cost-effectiveness, and the best organizational structure are still in progress. However, telemedicine appears to be a useful technique in the practice of oncology.


Current referral practice for ultrasonically detected fetal abnormalities contributes to prenatal anxiety, inconvenience to patients, diagnostic inaccuracy, and general service inefficiency. To determine whether telemedicine would reduce these disadvantages, we established a 30-channel ISDN link between a district general hospital on an island and a subspecialty referral center approximately 120 km away on mainland Britain. Live ultrasound images of the fetus were transmitted in realtime from a commercial scanner in the hospital using a total data transfer rate of 2 Mbit/s. After decompression at the receiving end, there was almost no perceptible loss of picture quality or frame rate. This report describes the technical aspects of the link and our preliminary experience with it. In the first two months of its operations, the link worked well and the consultants who used it found themselves confidently making diagnoses and carrying out counselling over it. If confirmed, the success of this technology has implications for future referral practice in fetal medicine.

OBJECTIVE: We performed a field study and subsequent laboratory investigation of pediatric radiology at a small rural hospital. Our investigation had three components: to describe the characteristics of pediatric radiology in a rural primary care facility, to test the diagnostic accuracy of interpretation of pediatric images transmitted by teleradiology, and to compare relative diagnostic accuracy of general and pediatric radiologists who interpreted pediatric images at a rural institution. MATERIALS AND METHODS: All 196 pediatric radiographs obtained during a 4-month period comprised the database from which we determined practice characteristics. Reports of 153 unselected cases interpreted by general radiologists using teleradiology were compared with interpretation of the same cases by a pediatric radiologist who interpreted the original radiographs. Discrepant cases were further investigated by a receiver-operating-characteristic curve experiment in which general and pediatric radiologists interpreted each case twice: once viewing teleradiologic images and once viewing the original radiographs at another setting. We then compared interpretive accuracy of observers and techniques. RESULTS: The pediatric radiographs were predominantly simple examinations for common acute disease, particularly pneumonia and fractures. Discrepancies of interpretation between teleradiology and original radiographs, which occurred in 13% of images, showed no significant difference in accuracy of interpretation for either teleradiologic images or original radiographs. Likewise, we found no significant advantage for accuracy of interpretation by general or pediatric radiologists. Receiver-operating-characteristic analysis of 18 discrepant cases showed slightly increased accuracy for interpretation of original radiographs by pediatric subspecialists. CONCLUSION: Simple pediatric radiographs obtained at a rural primary care institution and transmitted by teleradiology can be adequately interpreted by general radiologists. (Abstract by: Author)


We compared the accuracy of a low-cost teleradiology system with plain film at a small rural hospital. The comparison was a case-control, paired-comparison study. In total, 377 consecutive cases were read prospectively by teleradiology and later by independent interpretation of the plain films. 'Truth' was determined in discrepant cases by further investigation of available records and images. Sensitivity and specificity were determined for each modality, and agreement using the kappa statistic. There was 90% agreement between teleradiology and plain film, with no significant differences. Sensitivities (0.88, 0.89) and specificities (0.98, 0.98) of the two methods were almost identical. McNemar's test indicated no significant differences in the accuracy of the two modalities. We conclude that inexpensive teleradiology for small rural hospitals is equivalent to plain film for radiologists' interpretation.


We investigated the perceived quality of teleradiology services offered at a rural hospital in comparison with radiology provided by three other methods: 'circuit riding,' an on-site radiologist, and a hybrid arrangement. The research design was a case study, with interviews of administrators, technologists, and physicians at the rural hospital, followed by a structured survey of all staff physicians. Responses were analyzed both qualitatively and quantitatively. Both interviews and the survey indicated that teleradiology was perceived to be as accurate as on-site film interpretation. All other aspects of the service -- efficiency, reports, communications, and the overall contribution to patient care -- were judged to be poorer than on-site radiology. We conclude that the provision of acceptable teleradiology requires considerable attention to all
aspects of the radiology service, with attention to differences in institutional culture and mission, and to communication.


This article summarizes the US Military Telemedicine project and how telemedicine is used to support United Nations medical operations in Croatia and Macedonia.


The objective of this multicentre study was to undertake a systematic comparison of face-to-face consultations and teleconsultations performed using low-cost videoconferencing equipment. One hundred and twenty-six patients were enrolled by their general practitioners across three sites. Each patient underwent a teleconsultation with a distant dermatologist followed by a traditional face-to-face consultation with a dermatologist. The main outcome measures were diagnostic concordance rates, management plans and patient and doctor satisfaction. One hundred and fifty-five diagnoses were identified by the face-to-face consultations from the sample of 126 patients. Identical diagnoses were recorded from both types of consultation in 59% of cases. Teledermatology consultations missed a secondary diagnosis in 6% of cases and were unable to make a useful diagnosis in 11% of cases. Wrong diagnoses were made by the teledermatologist in 4% of cases. Dermatologists were able to make a definitive diagnosis by face-to-face consultations in significantly more cases than by teleconsultations (P = 0.001). Where both types of consultation resulted in a single diagnosis there was a high level of agreement (kappa = 0.96, lower 95% confidence limit 0.91-1.00). Overall follow-up rates from both types of consultation were almost identical. Fifty per cent of patients seen could have been managed using a single video-conferenced teleconsultation without any requirement for further specialist intervention. Patients reported high levels of satisfaction with the teleconsultations. General practitioners reported that 75% of the teleconsultations were of educational benefit. This study illustrates the potential of telemedicine to diagnose and manage dermatology cases referred from primary care. Once the problem of image quality has been addressed, further studies will be required to investigate the cost-effectiveness of a teledermatology service and the potential consequences for the provision of dermatological services in the U.K. (Abstract by: Author)


Telemedicine is changing the classical form of health care delivery, by providing efficient solutions to an increasing number of new situations: here we consider those which require some type of computer-supported cooperative work (CSCW) between health care professionals located in different clinical sites. This paper presents the design and development of a telemedicine system for remote computer-supported cooperative medical imaging diagnosis. The main and novel component of our system is a new CSCW distributed architecture, comprised by a collaborative toolkit to add audio conferencing, telepointing, window sharing, user's coordination and application synchronization facilities, either to existing or new medical imaging diagnosis applications. In comparison with existing CSCW products, mainly based on centralized architectures, our distributed toolkit is specially designed for telemedicine applications: to allow different levels of sharing between participants, to improve user feedback in highly interactive user interfaces, and to optimize the required communication bandwidth in order to implement a telemedicine CSCW application on almost any telecommunication network. This telemedicine CSCW system has been applied to build a cooperative medical
imaging diagnosis application, in which two doctors, located in different hospitals, need to achieve a cooperative diagnosis on haemodynamic studies using cardiac angiography images. The design of the graphical user interface for this kind of telemedicine CSCW systems, a critical component which conforms any telemedicine application, is also addressed with a new methodological approach, to assure the system usability and final user acceptance. The telemedicine cardiac angiography pilot has been implemented, tested and evaluated within the Research Project 'FEST-Framework for European Services in Telemedicine' funded by EU AIM Programme. (Abstract by: Author)


OBJECTIVE: The goal was to develop a low-cost, national, neurosurgical emergency teleconsulting system that is independent of vendor computed tomographic (CT) or magnetic resonance imaging (MRI) scanner type. METHODS: Charge-coupled device scanners are used to digitize hard copies of CT and MRI scans. An enhanced optical density range is achieved by using an algorithm to fuse data from multiple exposures at different integration periods. The system is based on personal computers using Microsoft Windows 3.11. Data are transmitted on a wide-area network at 128 kilobits/s, over Integrated Systems Digital Network lines. The network connects both neurosurgical departments in Ireland to all major hospitals with CT/MRI scanners. RESULTS: The scanner optical density is 0.05 to 3.0, with 2.24 to 2.5 line pairs/mm. Five-megabyte images are transmitted uncompressed in 6 minutes. To date, more than 750 CT and MRI scans have been transmitted. The system is completely automated, and operator acceptance has been very high. Images are automatically stored and displayed at the receiving workstation, where the images can be viewed and manipulated on-screen. This system has significantly enhanced acute neurosurgical patient care. CONCLUSION: The system is cost effective and simple to use, has gained widespread physician acceptance, and delivers an image quality superior to that of many commercially available systems. (Abstract by: Author)


OBJECTIVE: To test feasibility and acceptability of teleconferencing routine outpatient consultations. DESIGN: Exploratory trial of teleconferenced outpatient referrals of general practitioners. SETTING: An inner city teaching hospital and surrounding general practices. SUBJECTS: Six general practices linked to hospital outpatient clinics. MAIN OUTCOME MEASURES: Levels of participants’ satisfaction measured with self-administered questionnaires. RESULTS: 54 teleconsultations were performed in 10 different specialties. Few serious technical problems were encountered, and high levels of satisfaction with the consultations were reported by patients, hospital specialists, and general practitioners. CONCLUSIONS: Teleconferenced consultations for routine outpatient referrals with joint participation of general practitioner were feasible. These may have an important potential benefit for improving communication between primary and secondary care. (Abstract by: Author)


OBJECTIVE: Investigate the hypothesis that telemedicine, in the form of real-time audiovisual transmission, would permit accurate assessment of illness severity and allow improved triage for transport. METHODS: A prospective study comparing assessments of patients examined conventionally (in person) and remotely by a telemedicine link. Fifteen patients (3 months to 14 years of age) admitted to our emergency department were evaluated as if for transport. Patients were evaluated simultaneously by a physically present pediatric...
emergency room physician and by a pediatric critical care physician linked to the examining room by a broadband audiovisual link. Each physician completed a patient assessment questionnaire independently. The sensitivity and specificity of the patient assessment by the audiovisually linked physician were calculated. RESULTS: Sensitivity, ie, the ability of the remote, audiovisually connected telemedicine physician to detect abnormal findings, is 87.5%. Specificity, the ability of the remote physician to detect normal findings, is 93%. It is likely that sensitivity would be markedly improved with addition of an electronic stethoscope.

CONCLUSION: This study demonstrates that pediatric patients may be assessed accurately with a broadcast-quality real-time audiovisual system. Such a system may have dramatic implications for providing pediatric specialty and subspecialty care in underserved areas.


OBJECTIVE: To investigate the diagnostic accuracy of clinicians viewing a patient's history and static digital image set compared with clinicians who conducted office-based physical examinations of the same patients. DESIGN: Observational study. SETTING AND PATIENTS: One hundred sixteen adult patients presenting with dermatologic symptoms in a university-based practice who consented to have their skin conditions documented with a still digital camera according to a standardized protocol. MAIN OUTCOME MEASURES: Concordance between office-based dermatologists' diagnoses and 2 remote clinicians' diagnoses using still digital images (resolution, 92 dots per inch) and identical medical history data to render diagnoses. RESULTS: When photographic quality was high and office-based clinician certainty was high, remote clinicians were in agreement more than 75% of the time. Office-based and remote clinicians were in agreement 61% to 64% of the time for all cases. No specific disease category appeared to be more or less amenable to diagnosis based on still digital imagery. The diagnostic certainty of the office-based clinician (reported from 0-10) had the most impact on agreement. When cases with office-based clinician certainty of no more than 7 were compared with cases with certainty of at least 9, agreement increased 54% for remote clinician 1 and 111% for remote clinician 2. As an isolated variable, photographic quality had a modest impact on agreement. CONCLUSIONS: Still digital images can substitute for the dermatologic physical examination in up to 83% of cases. This study provides validation of the store-and-forward concept of telemedicine as applied to dermatology. These results serve as the foundation for field testing of the concept in primary care settings. (Abstract by: Author)


Information technology has enabled much of the business community to function in a time and place-independent manner. Health care has lagged in adopting this technology because of tradition, concern for patient security and confidentiality, liability, and licensure issues. This article reviews the current state of telemedicine technology, its applications, and opportunities for further development. Urology is identified as a specialty that stands to benefit from advances in technologies applicable to remote diagnosis, monitoring and care of patients, physician training, and record keeping. (Abstract by: Author)

STUDY OBJECTIVE: To study the roles emergency physicians have in a clinical telemedicine network. METHODS: A descriptive analysis of telemedicine consultations conducted by emergency physicians at 1 year of operation of a private clinical telemedicine program. RESULTS: From February 1, 1995, to February 1, 1996, 190 clinical telemedicine consultations were completed. Emergency medicine constituted the most common specialty consulted, accounting for 45 (24%) of the consultations. All consultations were one-time transmissions and interactions. They ranked as follows: trauma or orthopedic care, 33 (73%); adult medical problems, 6 (13%); and pediatric medical problems, 6 (13%). Of the emergency medicine teleconsultations, 39 (87%) were categorized as emergency (completed immediately). Of the emergency medicine consultations completed, 24 (53%) patients remained in the rural community, and 21 (47%) were transferred to the tertiary care facility for additional care. The primary peripheral used for emergency medicine teleconsultations was a one-chip document camera. Forty-three (96%) of the emergency medicine teleconsultations involved radiograph interpretations. The most common radiographs reviewed were of the arm, 14 (33%); leg, 10 (23%); and cervical spine, 7 (16%). There was one minor radiograph interpretation discrepancy. Of the emergency medicine teleconsultations, 65% occurred between 7 PM and 8 AM. Of emergency medicine teleconsultations, 24% were completed on Saturdays and Sundays, with 26% of consultations being completed on Fridays. All emergency physicians involved in telemedicine consultations were surveyed concurrently for satisfaction, future use, and recommendations for improvement. CONCLUSION: The technology afforded by telemedicine allows emergency physicians to participate in telemedicine consultations. Emergency physicians should consider using clinical telemedicine in their practice. (Abstract by: Author)


OBJECTIVE: To study the role of telemedicine in the delivery of trauma care to rural providers on a telemedicine network. METHODS: A descriptive analysis of 100 trauma teleconsults over a private telemedicine network from February 1, 1995, through July 31, 1996. RESULTS: Of 354 clinical teleconsults during the study period, 100 (28%) concerned trauma. The largest number of trauma teleconsults (54) were provided by orthopedic surgeons. Emergency physicians provided 33 teleconsults, radiologists 8, and neurosurgeons 5. The most common reasons for trauma teleconsults (94%) were diagnosis and treatment of extremity and pelvic injuries. The document camera was used for all teleconsults, primarily to transmit radiographs. The mean age of the patients was 32.3 years. Sixty-one of the teleconsults were categorized as urgent, 32 were emergency, and 7 were scheduled. The mean duration of the emergency teleconsults was 4.3 minutes, and the overall mean duration of all teleconsults was 8.6 minutes. Ninety of the trauma teleconsults occurred during regular week days, Monday through Friday. Radiologists reviewed all hardcopy radiographs and computed tomography films, and hard-copy interpretations were compared with interpretations at the time of the teleconsult. No significant discrepancies between the two modes of interpretation were noted. Of the 100 patients involved in trauma teleconsults, 68 stayed in the rural community. No significant adverse outcomes were observed among patients involved in teleconsults. CONCLUSION: This analysis confirms the clinical effectiveness of telemedicine technology in the evaluation and treatment of extremity and pelvic injuries. (Abstract by: Author)

The objective of this study was to study the delivery of orthopaedic care via a telemedicine network. This study is a descriptive analysis of orthopaedic teleconsultations done during a 2-year period by three orthopaedic surgeons. Four hundred ten teleconsultations were done during the study period from February 1, 1995, to December 31, 1996. Orthopaedic surgeons engaged in 91 teleconsultations (22% of all teleconsultations). Reasons for orthopaedic teleconsultations were: evaluation and treatment of fracture care (39 cases; 43%); evaluation and treatment of ligamentous injury, joint swelling and infection (32 cases; 35%); postoperative evaluation (16 cases; 18%); and evaluation and treatment of dislocations (four cases; 4%). Sixty-two (68%) of the patients remained in the rural community. Twenty-one (23%) of the orthopaedic teleconsultations were classified as emergent (done immediately). Thirty-five (38%) were urgent (done within 1 to 2 hours of provider request), and 35 (38%) were scheduled. The mean duration of time for teleconsultations was 12.8 minutes. Eighty-seven (96%) of the teleconsultations occurred Monday through Friday. Outcome data were collected on all patients involved in teleconsultations. No adverse patient outcomes occurred. This study suggests telemedicine may be an avenue for the delivery of orthopaedic care to patients residing in areas where orthopaedic specialists are not available. (Abstract by: Author)


**RATIONALE AND OBJECTIVES:** The authors' goal was to determine the feasibility and usefulness of online teleradiology consultation for emergency department physicians at a rural hospital. **MATERIALS AND METHODS:** Electronic linkage between the emergency department of Chatham County Regional Hospital (remote site) and the University of North Carolina Hospitals (host site) was established via a fiber optic network. From October 1995 through September 1996, teleradiology consultation was initiated by an emergency department physician at the remote site and was provided online by host-site radiologists using a commercially available teleradiology system and a high-resolution digitizer. The turnaround time for each teleradiology consultation was calculated, and the effect of the consultation on diagnosis and treatment was assessed. The emergency department physicians scored their satisfaction and comfort levels with the system by using a scale of 1-7, with 7 representing the highest and 1 representing the lowest satisfaction and comfort. The online soft-copy interpretation was compared with a later interpretation of the original hard copy. **RESULTS:** A total of 123 separate studies comprising 460 radiographs were successfully transmitted in 90 discrete teleradiology events. The mean turnaround time for a teleradiology consultation was 1.3 hours. The teleradiology consultations led to changes in the emergency department physician's initial diagnosis in 27 of 90 cases (30%) and resulted in treatment changes in 23 of 90 cases (26%). The emergency department physicians reported an average satisfaction score of 5.4 and a comfort level of 5.6 with the teleradiology system. No major discrepancy between soft- and hard-copy interpretations was noted. **CONCLUSION:** Online real-time teleradiology consultation is feasible with available technology. (Abstract by: Author)


**BACKGROUND:** Numerous telemedicine programs have been created in the United States, but studies documenting the fidelity and effectiveness of telemedicine for evaluation of skin diseases are lacking. **OBJECTIVE:** We attempted to determine the percentage of encounters in which two different dermatologists, one using telemedicine and one on-site, could independently arrive at the same primary diagnosis. **METHODS:** Two clinical telemedicine sites...
linked through the Georgia Statewide Telemedicine Program were used in this study of 60 patients with skin problems. One dermatologist evaluated the patients on telemedicine (interactive television) and a second then took the patients into a separate examination room and evaluated them on-site. Each investigator recorded their diagnoses with no discussion with each other. As a control group, the investigators independently and in a blinded fashion (to each other's diagnoses) recorded diagnoses for a group of patients from a third dermatologist's clinic. Raw data were evaluated and classified by this third dermatologist who assigned diagnoses to categories of complete agreement, partial agreement, or disagreement.

RESULTS: There were no significant differences with regard to disagreement. However, there was a higher probability of complete agreement between the two dermatologists when each examined the patient on-site and in person than when one evaluated the patient on telemedicine and one examined the patient on-site and in person. CONCLUSION: Our results suggest that telemedicine is an effective means of diagnosing cutaneous diseases. However, because partial interobserver agreement on diagnoses was greater for the telemedicine group than for the control group (p < 0.05), it is likely that optimum use of medical assistants at the remote site will be necessary to increase the likelihood of complete agreement on diagnoses among dermatologists using interactive television. (Abstract by: Author)


This study reports the results of the use of a low-cost videoconferencing system (LCVC) for communication in an acute psychiatric service. Qualitative research methodology was used to examine the use of the LCVC in interactions between psychiatrists, patients, and nursing staff, including information on refusals. One hundred and five clinical interactions were studied over four months. The LCVC proved technically reliable and compatible with the performance of a wide range of clinical tasks. However, the results suggest the need for better understanding of the nature and origins of the attitudes that users bring to the use of such communications technology. A framework is presented for the classification of user responses in terms of pre-existing attitudes of the users, technological limitations of the system, and the mental state of the users. The study demonstrated the potential for interactive television to support many of the communication tasks necessary in a dispersed psychiatric service and for telepsychiatry to become a major method of service provision.


OBJECTIVE: Our purpose was to establish whether obstetric ultrasonography interpreted by a live video telemedicine link is comparable to interpretation by videotape review in a low-risk patient population. STUDY DESIGN: An Integrated Services Digital Network (ISDN 6) was established from three satellite offices to our central prenatal diagnostic center. Patients seen at these satellite offices had a complete fetal anatomic survey recorded onto videotape by a trained ultrasonographer. A live interactive video telemedicine link was then established to our center by the digital network, and a perinatologist directed the ultrasonographer through the anatomy survey. Subsequently a different perinatologist, blinded to the telemedicine interpretation, reviewed the videotaped examination. The reports from the videotaped and telemedicine scans were then compared on the basis of a score of 33 anatomic items. RESULTS: The first 200 patients seen at the satellite offices were included. Telemedicine and videotape interpretations provided similar scores in 84% of scans. In 17 of the 33 anatomic categories telemedicine provided significantly better scores than videotape, whereas in the remaining 16 anatomic categories the scores were equivalent. More videotape than telemedicine examinations required repeat ultrasonography because of suboptimal imaging (10% vs. 3%, p = 0.003). CONCLUSIONS: The interpretation of obstetric ultrasonography with
use of live video telemedicine is comparable to videotape review. Fetal telemedicine may prove
to be a useful tool for providing ultrasonographic interpretation of fetal anatomy to a network of
low-risk obstetric practices. (Abstract by: Author)


OBJECTIVE: To report a pilot study of telemedical direct ophthalmoscopy in the
diagnosis of acquired immune deficiency syndrome (AIDS)-related retinopathy in a human
immunodeficiency virus (HIV)-positive population and in the diagnosis of glaucoma, cataract,
and retinopathy in a diabetic population. DESIGN: Prospective comparative case series.
PARTICIPANTS: Seventeen HIV-positive and 20 diabetic patients. METHODS: A direct
ophthalmoscope custom-fitted with a digital microcamera capable of transmitting images from
any of 61 sites within the Georgia Statewide Telemedicine Program was used by a
nonophthalmologist to examine 34 eyes of 17 HIV-positive patients and 39 eyes of 20 patients
with diabetes. Fundus images were transmitted in real-time to a reviewing ophthalmologist. An
in-person, comprehensive examination including indirect ophthalmoscopy, was performed by a
second ophthalmologist. Telemedical examination was compared to the in-person
comprehensive examination. RESULTS: For the HIV study, 21 eyes did not show HIV
retinopathy (noninfectious retinopathy with cotton-wool spots) by in-person examination.
Telemedical examination correctly identified 20 of these eyes as disease-free (specificity =
95%). HIV retinopathy was present in 12 of the 34 eyes by in-person evaluation with
telemedical examination correctly diagnosing 10 of these eyes (sensitivity = 83%). One eye
with dense cataract and retinal detachment was unable to be evaluated ophthalmoscopically by
either in-person or telemedical examination. Telemedical and in-person assessments for HIV
retinopathy were identical in 100% of eyes without cataract. Disagreement in diagnosis
between telemedical and in-person examination was associated with cataract (P < 0.0007). For
the diabetes study, because of an inadequate image, telemedical examination was unable to
classify 46% and 36% of eyes for glaucoma and diabetic retinopathy, respectively. Inability to
make a telemedical determination for glaucoma (P < 0.011), nonproliferative (P < 0.064) and
proliferative (P < 0.064) diabetic retinopathy was associated with cataract. Of the eyes that
were able to be assessed by telemedical examination for diabetic retinopathy (n = 25),
glaucoma (n = 21), and cataract (n = 39), the accuracy was poor (sensitivity = 29%, 50%, and
41%, respectively). Telemedical examination for diabetic retinopathy and glaucoma was more
likely to agree with in-person examination in eyes without cataract as compared to eyes with
cataract (not statistically significant). CONCLUSION: Telemedical direct ophthalmoscopic, real-
time fundus imaging may provide a valuable means for providing ophthalmic consultation to the
primary care physician in younger patients without lens or media opacity, but is inadequate for
eyes with any degree of lens or media opacity.


To evaluate the diagnostic accuracy of digitized film radiography and digital teleradiology
for detecting bone fractures and for studying solitary bone lesions, we examined 633 single
radiographs from 373 patients (159 with solitary bone lesions, 123 with fractures, and 91 without
pathology). Radiographs were digitized using a commercial teleradiology workstation and
transmitted to a local hospital over a standard telephone line. Images were reviewed by two
groups of three experienced radiologists. Receiver operating characteristics (ROC) curves
were analyzed for conventional films, digitized images and transmitted teleradiology images.
No significant differences were found among readers for the evaluation of bone fractures and
solitary bone lesions. Teleradiology systems permit remote expert consultation, and
telediagnosis, therefore, is a powerful tool in telemedicine.

OBJECTIVES: To assess the reliability of telemedicine examination and identify the issues to be addressed if the conduct of physical examination and the reading of images and tracings by telemedicine are to be as reliable as conventional examination and reading.

METHODS: Patients were examined both conventionally and by telemedicine in 12 clinics, and the results were compared. There were 1826 matched pairs of observations. Cardiac auscultation, echocardiography, electrocardiography, electroencephalography, obstetric ultrasonography, ophthalmologic examination, physical therapy assessment, pulmonary auscultation, and the reading of chest radiographs with telemedicine cameras and monitors were studied. The main outcome measure was agreement between the telemedicine findings and a criterion standard.

RESULTS: For ophthalmology, physical therapy, and cardiac auscultation, 91.2% of the conventional findings and 86.5% of the telemedicine findings were identical or similar to the criterion standard. The kappa coefficient on matched-pair analysis was 0.66. For pulmonary auscultation and reading of chest films with a telemedicine camera and monitor abnormalities were suppressed at default settings but subsequently revealed with extensive manipulation of system settings. For tracings and images, both conventional and telemedicine findings showed 92% reliability, with a kappa coefficient of 0.87.

CONCLUSIONS: On the basis of these observations and the methods used, reliability varied with the type of examination, clinician experience with telemedicine, and participant knowledge of system limitations. Clinicians without experience or knowledge of system limitations missed findings of clinical importance. Improvements in equipment since the clinics were conducted in 1994 may have resolved some of these problems. Our findings raise doubts about the reliability of occasional telemedicine consultations by clinicians inexperienced in the technology. (Abstract by: Author)


BACKGROUND: The dermatologic needs of many communities in the United States and worldwide are underserved. Telemedicine enables physicians and non-physician primary care providers to use modern telecommunications devices to gain access to specialist consultations promptly and with much less travel. The independently developed telemedicine programs described herein support three traditionally underserved populations: Pacific Islanders, migrant farm-workers, and prison inmates.

OBSERVATIONS: In three independently designed telemedicine programs, dermatology emerged as the specialty most used by remote practitioners. Patients were presented for both diagnosis and treatment and in the setting of initial evaluation and as part of follow-up care.

CONCLUSION: Teledermatology is a useful way to provide dermatologic support to remote or underserved communities. (Abstract by: Author)


The preliminary survey for the telemedicine assessment project was carried out in 1996 jointly by the Health Care Districts of Northern Finland and Southwestern Finland, and FinOHTA. The participants of the project include the Departments of Radiology, Psychiatry, Surgery and Ophthalmology of the Oulu University Hospital and the Pathology Unit of the Turku University Central Hospital. The clinical research will be conducted independently by each participating clinic. The cost-benefit and cost-effectiveness analyses will be performed by one investigator. The parameters have been made as commensurate as possible among the various subprojects. With this objective in mind, a common framework of assessment (a recommendatory list of themes to be addressed in the assessment) has been prepared, to be
presented in the present report. The project of telemedicine assessment has five foci, some of which are concerned with clinical work and some with the transfer of examination data. For telesurgery, the use of video conferencing in the context of first and follow-up visits of mainly orthopaedic patients is studied. The patients will be randomised between a video conference held at a primary health care centre and a visit to the outpatient clinic of a central hospital. As for teleophthalmology, the follow-up of glaucoma and retinopathy patients will be assessed. Some of the examinations will be carried out at the Department of Ophthalmology of the Oulu University Hospital while some of the fundus photographs and other examination data will be transmitted from the primary health care centre to the Oulu University Hospital via telecommunication networks. At the same time, more responsibility for the treatment and follow-up of patients will be shifted to primary health care centre physicians. As for teleradiology, the transmission of radiographs from primary health care centres and CT scans from hospitals to the Department of Radiology of the Oulu University Hospital will be studied. If necessary, the physician requesting consultation may ask, in addition to the radiologist's opinion, for the opinion of a surgeon, neurosurgeon or paediatrician. As for telepsychiatry, video conferencing is already being used in teaching, training, guidance and clinical work. The present project focuses especially on meetings for planning patient care. Provided the patient's consent is obtained, these are carried out between the primary health care centre of the patient's municipality and the Department of Psychiatry. As for telepathology, the study covers the transfer of micrographs of frozen sections from the Central Hospital of Mariehamn to Turku, as well as consultations between a pathologist in another central hospital with a pathologist at the Turku University Central Hospital. The economic assessment of telemedicine has the following components: Cost analysis will include direct costs to the social welfare and health services and to the patient as well as indirect costs arising from treatments. Both the current and the telemedical procedure will be analyzed. The expenditure associated with service transactions will also be investigated. The study of the effects will mainly concentrate on changes in diagnostic and treatment processes. Clinical change and follow-up of health-related quality of life will receive less emphasis, since telemedicine is expected to produce the same health effects as conventional methods. Nevertheless, telemedicine is expected to significantly improve the proficiency of the primary health care centre physician. The study also includes an investigation into the technical characteristics of the telemedical applications used. Physicians, nurses and patients will also be asked about their satisfaction with the method. Regarding study designs, randomization will be preferred, but in many cases before/after comparisons will have to suffice. The assessment methods include cost-benefit and cost-effectiveness analyses. The data will be subjected to sensitivity analyses to determine the effects of changes in prices of equipment, manpower requirements, equipment specifications, etc., on the conclusions of the assessment.


To overcome problems associated with the faxing of ECGs, we developed a telemedicine system providing fast transmission of ECGs between physicians and cardiologists at different locations. It digitized ECGs at a resolution of 300 dots/inch (118 dots/cm), processed them, and transmitted them over a standard telephone line in under one minute. The system also paged the cardiologist in order to direct him or her to the location where the ECG would be waiting for interpretation. The system enabled physicians at remote locations to consult using voice, images, and simultaneous cursor pointers. A transmitting site was set up at the Medical Centre of the Ministry of Defense and a receiving site at the National University Hospital, about 5 km away. During a six-month trial, 200 ECG reports were transmitted from one site to the other. They were rated excellent in quality by the cardiologists, being virtually
indistinguishable from the originals. Our telemedicine system transmits high-quality ECGs rapidly and at low cost.


Telemedicine can be defined as the use of telecommunications technologies to provide medical information and services. This field has recently begun a period of explosive growth. Oregon’s teledermatology program within the National Library of Medicine's high-performance computing and communications initiative is designed to generate much-needed basic and clinical research information about one specific telemedicine application. The background of this program is discussed, and the research objectives are described. (Abstract by: Author)


BACKGROUND: Recent advances in telecommunications technology allow physicians to consult on patients at a distance via an interactive video format. Few data exist as to the reliability of this form of consultation. OBJECTIVE: Our purpose was to measure the degree of concordance between a dermatologist seeing a patient in a clinic and another dermatologist seeing the same patient over a commercially available videoconferencing system. METHODS: Patients referred to a general dermatology clinic were seen by both a "live" dermatologist and a "teledermatologist" via a T1 connection. Diagnosis and recommendations were recorded by both physicians and compared. The physicians were also asked to rate the degree of confidence they had in their diagnosis. RESULTS: Seventy-nine diagnoses were made on 60 patients. The two physicians were in absolute agreement on 61 of the diagnoses (77.2%). Race or sex of the patient, nature of the skin problems, or which of the two physicians was the teledermatologist did not statistically correlate with the concordance of the two physicians. CONCLUSION: There was a reasonable degree of agreement between the two examining physicians. Despite the relatively high degree of concordance the teledermatologist had a significantly lower degree of confidence in his diagnoses. (Abstract by: Author)


A telemedicine system was installed between the University of North Carolina Hospitals and the New Hanover Regional Medical Center. It allowed the transmission of neonatal echocardiograms for immediate reporting. During a six-month study period, the system was used for the interpretation of 110 echocardiograms from 48 babies. There were 38 babies studied in a retrospective control period. Hospital length of stay decreased by an average of six days in the telemedicine group, representing an annual saving of some $1.3 million. However, these apparent differences were not significant (p = 0.2) and a power analysis suggested that a sample size of some 600 would have been necessary.


Review of the role of telemedicine in pediatric emergency patients. It gives the results from one pilot study, concluding that modes of transport can be chosen appropriately and the composition of transport teams can be tailored to the patient’s condition.

Airline passengers, seafarers and islanders are three different examples of people who can benefit from telemedicine. However, the peculiar characteristics of each group require different applications. In 60 years of activity, the CIRM has assisted more than 37,000 patients. In the 10 years from 1986 to 1996 the Centre provided radio medical assistance to 7647 patients, of whom 6981 (91.3%) were sailors, 642 (8.4%) were people living in isolated areas (small Italian islands) with few medical facilities, while only 24 patients (0.3%) were airline passengers. In the same period, the telecommunication service received or transmitted almost 80,000 medical messages. (Abstract by: Author)


Shahal serves over 40,000 cardiac, pulmonary and blood pressure subscribers. The system combines emergency home care and telemedicine in a patient-initiated system geared towards the prevention of cardiac and pulmonary complications. About 150,000 calls are received per year. The median time from onset of symptoms to a call for help is 44 min. It is a unique system which has been shown to facilitate improved home health-care control, enabling patients to manage their own health condition and providing them with a higher quality of life and enhanced peace of mind. (Abstract by: Author)


The reliability of psychiatric diagnoses made remotely by telecommunication was examined. Two trained interviewers each interviewed the same 30 psychiatric inpatients using the Structured Clinical Interview for DSM-III-R. Fifteen subjects had two in-person interviews, and 15 subjects had one in-person and one remote interview via telecommunication. Interrater reliability was calculated for the four most common diagnoses: major depression, bipolar disorder, panic disorder, and alcohol dependence. For each diagnosis, interrater reliability (kappa statistic) was identical or almost identical for the patients who had two in-person interviews and those who had an in-person and a remote interview, suggesting that reliable psychiatric diagnoses can be made via telecommunication. (Abstract by: Author)


PURPOSE: To compare accuracy of interpretation by radiologists and emergency medicine physicians of conventional radiographs and digitized images on a workstation. MATERIALS AND METHODS: One author selected 120 radiographs from the radiology department library, including 62 musculoskeletal, 20 abdominal, and 38 chest examinations. Analog radiographs were digitized. There were 60 positive and 60 control cases. Positive cases demonstrated clinically important disease and had a high degree of diagnostic difficulty. Thirty-one cases were judged to be critical to the patient’s immediate care, requiring prompt accurate interpretation. Four groups of readers were used: staff radiologists and emergency medicine physicians and second-year radiology and emergency medicine residents. RESULTS: All reader groups performed better when interpreting conventional radiographs than digitized images. Differences in favor of radiograph reading were statistically significant for overall accuracy related to all cases and to critical cases (P < .05, one-tailed test). CONCLUSION: Results with the teleradiology system were found unacceptable for primary interpretation of the spectrum of radiographs seen in an emergency department. (Abstract by: Author)

This article examines the current status of simultaneous voice and electrocardiographic TEM in hospital, home and clinical settings.


PURPOSE: To report the feasibility of real-time video and audio transmission of slit-lamp images of the eye using conventional telephone systems. METHOD: We analyzed the feasibility and benefits of telemedicine in the diagnosis and follow-up of ocular surface disorders in referral patients using a real-time audio-video system that functions through integrated services digital network lines at a transmission speed of 384 kilobytes per second. RESULTS: Real-time slit-lamp images obtained through integrated services digital network lines offered satisfactory visual resolution of the ocular surface for the diagnosis and follow-up of ocular surface and corneal disease, while simultaneous audio transmission allowed for direct communication with the patient and attending physician when necessary. CONCLUSION: Telemedicine using conventional telecommunication infrastructures offers sufficient information for the diagnosis and follow-up of ocular surface disorders in referral patients. (Abstract by: Author)


The system of telemedical care practiced by the British Antarctic Survey has developed over a period of 50 years. It is a system that deals with everyday routine medical problems as well as occasional emergencies. It is tried and tested, but undergoes continual modification. Although the Antarctic stations represent a unique setting, the system has the potential for being adapted to many different situations, wherever there are small groups in remote areas needing medical backup. Initial telemedicine work conducted in the Antarctic has led to projects to improve primary care in Scottish communities some distance from specialist centres. As telecommunication links to the Antarctic stations improve, in future the lessons learnt in UK-based projects can be applied in the Antarctic. The evolutionary process will thus continue. (Abstract by: Author)


A major disadvantage of rural medical practice is the limited reserve of consultative options. To determine the perceived clinical utility and educational impact of the West Virginia University Medical Access and Referral System (MARS), a 24-hour prompt telephone-consultation service, a mailed questionnaire was administered to 303 West Virginia clinicians who had used MARS for infectious disease problems. The overall questionnaire response rate was 62 percent. Callers included family practitioners (35%), medical specialists (32%), surgical specialists (13%), pediatricians (11%), obstetricians (5%), and non-physicians (4%). Major referral questions posed were therapeutic (60%), diagnostic (48%), and epidemiologic (10%) in nature. On a scale of 1 (not useful) to 5 (very useful), survey responders rated the overall clinical usefulness of MARS as either a 4 (22%) or 5 (76%). Callers felt that MARS consultation assisted in accurate case diagnosis in 80 percent of cases, and aided in successful therapeutic management of 96 percent of cases. An educational benefit was reported by 96 percent of responders. Physicians located in more rural, underserved areas tended to use MARS to a greater degree than colleagues in more populated, medically accessible areas (P < 0.005). These findings suggest that an academic telephone-access consultation program can be a
clinically relevant and educational consultative tool for practicing clinicians, especially those located in rural areas. (Abstract by: Author)


A clinical data-collection form was designed for use in the consultation process between an astronaut and Earth. It can also be applied in most remote health care settings. The form was tested by non-medically trained individuals in 101 simulated and 19 real cases. A completion rate of 88% was achieved, with a diagnostic accuracy of 85%. This compares favorably with studies by other workers in the field of medical decision support. Space telemedicine research will contribute to developments that will benefit not only space activities but also terrestrial applications.


Dobutamine stress echocardiography (DSE) was performed on 26 patients admitted for chest pain deemed at low risk for myocardial infarction. Pharmacologic stress in the emergency department on a 24-hour basis was administered by nurses and echocardiographic ultrasonographers with electrocardiograms and echocardiograms being interpreted through telemedicine relay by an off-site cardiologist. Target heart rate was achieved in 84% of patients with an average peak dobutamine dose of 48 microg/kg/min. Echocardiographic transmission to the cardiologist over standard telephone lines took 9 minutes per quad-screen cine-loop display. The entire protocol added 2.2 hours to the emergency room evaluation. The one patient out of 26 who had incipient myocardial infarction was diagnosed by resting echocardiography. The remaining 25 patients were found clinically to have no infarction or ischemia. Of these, 22 out of 25 had normal DSE in the emergency department; three had wall motion abnormalities on peak stress images. Another three patients had other cardiac diseases documented by echocardiography. Evaluation of chest pain on a 24-hour basis with DSE with telemedicine interpretation appears to be a rapid and safe means of screening patients at low risk in the emergency department. Further experience with this modality is needed before all patients should be enrolled or early discharge of patients on the basis of DSE can be advised. (Abstract by: Author)


OBJECTIVES: The practically and accuracy of dobutamine stress tele-echocardiography (DSTE) were assessed in patients presenting to the emergency department with chest pain. BACKGROUND: Many patients evaluated for chest pain in the emergency department (ED) are admitted to the hospital needlessly because of the difficulty in differentiating noncardiac chest pain from myocardial ischemia. METHODS: One hundred sixty-three patients with no evidence of myocardial infarction on initial blood studies or the electrocardiogram who were recommended for hospital admission to rule out myocardial infarction or myocardial ischemia were enrolled in this four-phase study. Rest echocardiography was performed in the ED, and the images were transmitted to a cardiologist for interpretation. If the results were normal, DSTE was then administered by a trained nurse. In the first three phases, all patients were admitted for observation regardless of the results of DSTE. In the fourth phase, those having normal DSTE results were able to be released. RESULTS: The test was completed within an average of 5.4 h of presentation to the ED. The sensitivity and specificity of DSTE versus clinical and cardiac catheterization findings were 89.5% and 88.9%, respectively, with a
negative predictive value for DSTE of 98.5%. Patients experienced frequent mild side effects (54.7%), but few (6.3%) caused the test to be discontinued prematurely. In phase 4 of the study, 72% of those slated for hospital admission because of cardiac risk factors and chest pain suggesting myocardial ischemia were discharged after normal DSTE results. CONCLUSIONS: The use of DSTE in the evaluation of patients presenting with chest pain may improve screening for those who can be safely released from the ED. (Abstract by: Author)


OBJECTIVES: This study sought to assess the clinical utility of interpreting emergency echocardiograms after regular working hours through a telemedicine connection to on-call cardiologists. BACKGROUND: Physician interpretation of emergency echocardiograms is often delayed during weekends, evenings or night hours. This delay places undue responsibility on less qualified personnel to interpret echocardiograms of vital importance. METHODS: Digital quad-screen cine-loop format was transmitted over standard telephone lines. Clinical data and conventional and telemedicine interpretations were collected prospectively for 187 emergent or semiemergent tele-echocardiograms after regular working hours. RESULTS: Indications for the echocardiogram included assessment of left ventricular function, ischemia, pericardial effusion, valvular disease, heart donor status and arrhythmia. Three off-site echocardiographers received the standard echocardiogram and spectral, gray-scale and color flow Doppler images in cineloop format using a laptop computer. Laptop interpretation showed 19 technically limited studies, 153 abnormal studies and 54% with wall motion abnormalities. Overall mean agreement rate between telemedicine laptop interpretation and conventional workstation interpretation performed in blinded manner for serious disorders with classic echocardiographic findings (pulmonary hypertension, left ventricular thrombus, aortic dissection, severe valvular insufficiency and large pericardial effusion) was 99.0% (95% confidence interval [CI] 96% to 99%). For serious wall motion abnormalities, the agreement rate was 96.3% (95% CI 92% to 99%). The following mean times elapsed after completion of the echocardiogram: to laptop fax report, 2.14 (range 10 min to 8 h); to dictation of videotape, 11.74 h (p < 0.001); to transcription of videotape diction, 56.6 h (p < 0.0001). CONCLUSIONS: After-hours emergency echocardiography telemedicine using a laptop computer is more rapid than scheduled conventional interpretation from a videotape workstation, yet diagnostic accuracy is comparable. (Abstract by: Author)


The Telemedicine Centre at Sismanoglion Hospital of Athens is connected to seven primary care units (HCCs) on the mainland and six HCCs on Aegean islands. Telemedicine activity from 1992 to 1995 was reviewed. During the study period, the data relating to 1947 cardiac patients were transmitted through the telemedicine network: 681 (35%) of the patients presented with cardiological problems and 333 (17%) of them had an urgent cardiac event. The telemedicine network brought a number of benefits, including better access to cardiology specialists, improved decisions about patient transportation, a reduction in isolation, and continuing professional education.


See Applications of Methodology—Emergency Medicine.

OBJECTIVE: Our purpose was to study the ability of personal computer teleradiology (PCT) to improve the quality of communication between physicians during newborn infant transfers and consultations. STUDY DESIGN: In the first part of the study 36 radiographs of neonatal intensive care unit patients were transmitted by PCT. The pediatrician reviewed the original films and three neonatologists reviewed the PCT images. Their interpretations were scored by use of criteria established by a neutral reader. In the second part chest x-ray films (CXR) of 31 newborns weighing > 2000 gm with respiratory distress were transmitted by PCT. A pediatrician and three neonatologists participated in an exercise to simulate a telephone neonatology consultation. Patient severity assessments as measured by assignments to receive intermediate or intensive care were compared before and after neonatologists viewed the PCT image of the CXR. RESULTS: In part 1 of the study neonatologists correctly identified 98%, 91%, and 98% of the x-ray interpretation scoring items, whereas at best the pediatrician identified 82% of the scoring items (p = 0.002). In part 2 neonatologists correctly assigned patient care levels an average of 73% after reviewing a standard clinical profile and a written description of the infant's CXR. After reviewing a PCT image of the infant's CXR, patient care level assignments were correctly assigned an average of 67%. The interpretation of the PCT CXR image was consistent with the radiologic report of record in 90 of 93 interpretations (31 cases read by three neonatologists). CONCLUSIONS: PCT represents an inexpensive means to accurately send a radiographic image over the phone as part of a telephone consultation. Neonatologists were able to interpret teleradiology images more accurately than a pediatrician reviewing the original film. Although this did not result in an improvement in the neonatologists' ability to determine patient severity on the basis of the model used in part 2, their identification of serious radiographic findings missed by the pediatrician can only suggest that teleradiology may be beneficial in certain instances. Although verbal communication can often suffice in a telephone consultation or transfer, there may be specific instances when visualizing a radiographic image such as an x-ray film or computed tomographic scan can provide important information that cannot be optimally described verbally. Rural hospitals can form interhospital image transmission links with tertiary center resources. (Abstract by: Author)


Teleradiology images of 14 cervical spine x-rays were studied by radiologists to compare radiological diagnostic interpretations and image quality with an inexpensive personal computer (PC) teleradiology system adapted to personal computers. Image quality ratings were similar for the conventional teleradiology images, PC teleradiology images, and the original cervical spine films. Interpretations of images showed some variation between PC and conventional teleradiology. Lesions in poorly contrasted films were visible with difficulty, using PC teleradiology. Lesions in well-contrasted films were identified easily with all three image types. Inexpensive teleradiology can be achieved using PC devices already on the market for $650 to $2000 compared with $30,000 for conventional teleradiology. Standardization of image and modem transmission parameters may facilitate the development of interhospital image transfers to optimize patient transfers and to assist in long-distance patient consultations. PC teleradiology deserves further study. (Abstract by: Author)

The purpose of this article is to describe an inexpensive way to transmit CT scan images using personal computers, and to report on this brief experience with scanning and faxing images such as CT scans.


The use of videoconferencing in mental health provision is well described. During 1996, the author provided regular telemedicine supervision sessions to the Alice Springs mental health team some 2000km away. These were provided using telemedicine equipment at the Royal Brisbane Hospital. Sessions used roll-about units connected at 128kbs via ISDN lines.


OBJECTIVE: To examine a still-image store-and-forward teledermatology system for use in the care of nursing home residents. DESIGN: Diagnosis and treatment plans made from a teledermatology system were compared with those made from an on-site dermatology consultation. SETTING: This study involved the dermatologic care of nursing home residents. PATIENTS: Dermatologic consultations sent to the senior author's office from the participating nursing home were eligible for the study. In a consecutive manner, 29 residents with a total of 30 skin conditions were enrolled. INTERVENTION: A nurse collected and sent the histories and images using the teledermatology system. A diagnosis and treatment plan was determined by examining a transmitted still image and patient history alone and in combination by 2 to 3 dermatologists independently. An independent dermatologist made an on-site dermatologic consultation within 2 days after the images had been collected. MAIN OUTCOME MEASUREMENT: The diagnosis and treatment plans made from the teledermatology system were compared with those made by the on-site dermatologist. RESULTS: Twenty-nine patients with 30 skin conditions were enrolled in the study. Correct diagnoses were made for 60 (67%) of 90, 51 (85%) of 60, and 53 (88%) of 60 patients given the history alone, image alone, and both, respectively. The correct treatment plan was seen in 63 (70%) of 90, 52 (87%) of 60, and 54 (90%) of 60 patients given the history alone, image alone, and both, respectively. No incorrect diagnoses or treatment plans would have given rise to substantial morbidity. The dermatologists felt comfortable in making a diagnosis and treatment plan in all cases in which they had access to both the image and patient history. CONCLUSION: This study provides evidence that nursing home teledermatology consults may replace some on-site consultations by offering quality care in a cost-effective manner. (Abstract by: Author)
Economic Evaluation


Telemedicine systems offer many potential advantages for health care delivery. Most reports have centered on the delivery of primary and medical subspecialty care rather than on its impact on patient care and the potential for cost savings. In 1993, NeuroLink, a wide-area teleradiology network for delivery of specialty care in neurological surgery at Allegheny General Hospital, was implemented. This study was designed to determine the potential cost savings of such a network. Conclusion: the neurosurgical wide-area computer network led to more appropriate transfer of patients to a tertiary facility and significant estimated cost savings.


A cost comparison of three different methods of providing consultations for ear, nose and throat (ENT) problems was carried out. The study was based on the delivery of ENT examination and treatment to a small primary-care centre without an ENT specialist in Northern Norway. The three alternatives evaluated were teleconsultation, a visiting specialist and patient travel to the nearest second-care centre. Patient travel was cheaper for patient workloads below 56 per year. For patient workload above 56 and below 325 patients per year teleconsultation was the cheapest alternative. Above 325 per year, the visiting specialist service cost less than either teleconsultation or patient travel. Transfer of medical skills from the specialist to the general practitioner was also accounted for, separately from the main cost calculation. Teleconsultation then became cost-effective for patient workloads above 52 patients per year.


An economic analysis of the teleradiology service provided by a university hospital to a local hospital without radiologists was carried out. The average workload at the local hospital was 6000 patients (8000 examinations) per year. In these circumstances, teleradiology cost NKr108 per patient, in comparison to NKr178 per patient for the visiting radiologist service, which had previously been provided. The total cost of the teleradiology service amounted to NKr646,900 per year; in comparison the visiting radiologist service cost NKr1,069,000 per year. Calculations showed that for teleradiology to be cheaper, the workload had to exceed 1576 patients per year. A sensitivity analysis showed that assuming a shorter equipment lifetime, for instance four years rather than six years, made the threshold value 2320 patients per year instead of 1576.


Potential cost reductions to purchasers of 15,210 pounds per year can be achieved by a new telecardiology service compared to existing cardiology services on the Isle of Wight. Patients using a telecardiology service instead of attending outpatients on the Isle of Wight could also potentially save the economy up to 20,843 pounds per year from reduced travelling costs and time. However, telemedicine also offers the potential of numerous other quantitative and qualitative benefits, such as hospital cost savings and benefits to doctors, ancillary staff, and patients.

See Applications to Telemedicine—Satisfaction and Acceptance.


Costs were monitored for three different types of oncology practice: a telemedicine clinic and a fly-in outreach clinic, both held in rural areas, and a traditional clinic held in a city hospital. Total expenses were calculated over the year May 1995 to April 1996. The average cost per telemedicine visit was $812. The average cost per outreach clinic visit was $897. Flying in oncology support for this practice was, therefore, about 10% more costly than telemedicine. While the outreach cost may have been inappropriately high due to a slow start-up phrase, it was still less expensive during this period to be seen via telemedicine. For comparison, the average cost per traditional oncology clinic visit was $149. However, this figure does not take into account the costs of access to a city-based service by rural patients.


In 1991, East Carolina University established telemedicine services providing consultations to the largest prison in NC, in Raleigh. In 1995, a study was done to quantify the costs and benefits of inmate care under a four year contract, and to compare those costs and benefits with the costs of providing specialty medical care by using offsite visits to local medical specialists. This article reports their results.


A three-year experience in urban telemedicine is presented. The digital technology linking a community teaching hospital to a nearby clinic is described, as is the typical protocol for the consultations. The medical advantages and disadvantages, the security implications, and the cost-effectiveness of this project are analyzed. (Abstract by: Author)


The use of economic evaluation techniques in assessing health interventions, particularly cost-effectiveness analysis has grown greatly the past few years. This article briefly reviews the basic methodology employed and points out some of the limitations in the current state of the art, with the intention of helping the consumer.user of economic evaluation studies better to understand and interpret them.


To develop a cost-effective method of sharing educational resources, a dial-up teleconferencing network was implemented between three radiologic sites for a 30-day period of evaluation. By means of standard dial-up telephone channels, compressed video and audio signals displayed radiologic images, slides, and text, allowing residents and faculty from the three sites to participate in sight and sound interactions. Each of the three sites used compressed video/audio coder-decoders (codecs) conforming to the Consultative Committee on International Telegraphy and Telephony H.261 standard. Four video cameras were used at each site, and the audio was run in full duplex mode. A multipoint video bridge was used to broadcast codec output signals to the input lines of the other codecs. Our evaluation found
audio quality to be suboptimal, but capable of being improved; diagnostic image quality was adequate when a video zoom mode was used; the digital-archive mode of the codec proved advantageous; the H.261 codec permitted participation from all sites; and all conference lecturers were able to conduct their conferences as they were accustomed. Although audio quality and spatial resolution need to be improved, the results of this pilot study imply that dial-up compressed video conferencing has the potential to become a practical, cost-effective method of sharing educational resources by means of interactive radiologic multisite educational programs.


Picture archiving and communications systems (PACS) have emerged as an important part of digital imaging technology. However, the future of PACS is uncertain because its economic viability is in doubt. Cost-effectiveness analysis is an accepted technique for evaluating the economics of new technologies. This paper addresses the cost-effectiveness of PACS and identifies factors that are important in determining the cost of PACS relative to film-based radiology. These include the impact of PACS on physician productivity, maintenance costs, discount rates, and the time period for amortization of capital goods. The effectiveness of PACS is also explored in terms of improvements in diagnostic accuracy and timely diagnosis. Financial and clinical impacts should be integrated to provide information about how PACS expenditures will affect radiology departments, hospitals, and national research and development objectives.


Teleradiology is an import addition to diagnostic medicine and it permits more timely access to experts. It has special applications for rural areas, where access to care is often problematic. Teleradiology has the potential to reduce costs and improve quality but how it will be used depends on financial incentives and other institutional factors. This paper explores the costs, effects, and forces shaping the use of teleradiology in rural areas.


Teledermatology is no longer a futuristic curiosity; several general practices across the UK are now preparing to be electronically linked to other medical services for the purposes of referral and telediagnosis. Further, digital imaging in dermatology has been the subject of considerable research in recent years, largely because of its application to telemedicine. Indeed in the UK, geographically isolated general practices in North Powys have already demonstrated the effective delivery of dermatological expertise through a video-conferencing link to a consultant dermatologist at Aberystwyth Hospital, thereby reducing the need for patients or the consultant to travel long distances. (Abstract by: Author)


We carried out a feasibility study of the use of a home telecare intervention to promote skin and other self-care activities for clients with spinal cord injuries (SCIs) following their discharge from a rehabilitation facility. Eleven clients (mean age 38 years) participated in at least three video-sessions over a minimum of six weeks. The equipment used was a videophone which could transmit both audio and still images over an ordinary telephone line. The overall impressions of the 11 clients were very positive. Weekly telecare sessions for four to six
weeks, followed by telephone counseling alone every other week for four weeks, appears to be the appropriate sequence for most SCI clients.


In a pilot study of primary care telecardiology, 2,563 consultations were carried out over 18 months. Following teleconsultation, 2,076 patients (81%) were found to be suitable for management entirely by the general practitioner, without the need for referral to hospital. The system identified 487 patients (19%) with cardiac problems who required either admission to hospital or outpatient assessment. There was a resultant saving of referrals to hospital accident and emergency departments. Extension of the telecardiology service to include echocardiography may result in faster access to diagnosis and better management of patient heart failure, improving patients' quality of life and reducing hospitalization.


We carried out a cost analysis of a teleradiology system for emergency computerized tomography (CT) examinations. Teleradiology was implemented by connecting two spiral CT scanners in the University Hospital in Innsbruck and the Regional Hospital in Zwettl. It enabled the remote hospital in Zwettl to get fast and competent reports of emergency CT examinations when there was no specialist radiologist available. In 13 months' use for routine night and weekend service, the system proved fast and reliable. During the study period 121 emergency examinations of 116 patients were transmitted from Zwettl to Innsbruck. The fixed costs of teleradiology were for the ISDN connection and amounted to (Austria) DM230 plus DM696/year rental. The average cost of one emergency CT examination by teleradiology was DM372 (range 308-453). One possible alternative, transporting the films by taxi for reporting elsewhere, was cheaper (estimated cost DM156), but would have been much slower. Another alternative, transporting the patient to the nearest central hospital for scanning, was much more expensive: DM524 by road or DM4667 by helicopter ambulance. (Abstract by: Author)


Although recommended as part of a comprehensive pacemaker follow-up protocol, the diagnostic and cost-effectiveness of routine telephone monitoring (TM) in children in the United States is largely unknown. Patient age and size with inherent age-related problems and potential inability to correlate symptoms with pacemaker performance places the pediatric patient in a unique category, different from that of the adult. A total of 96 patients, ages 0.2 - 32.0 years (mean 12.0 years) were followed for three years after pacemaker implant with both routine monthly and anytime emergency TM. A total of 1,372 routine transmissions were performed of a recommended 3,456 (40% patient compliance). Of these, 99% showed normal rhythm or pacemaker functions. The remaining 1% demonstrated asymptomatic pacemaker dysfunction requiring intervention or new-onset dysrhythmias. A total of 75 emergency transmissions were undertaken for patient/parent-perceived problems, only 8% of which showed pacemaker dysfunction or dysrhythmias. The sensitivity of the patient/parent capacity to detect pacemaker problems or dysrhythmias based on clinical findings was 29%, with a positive predictive value of 8%. The specificity of routine monthly TM to screen for asymptomatic pacemaker dysfunction or new-onset dysrhythmias was 95%, with a negative predictive value of 99%. TM was effective (p <0.001) for correlating the presence or absence of pacemaker problems with subjective complaints at any patient age. Financial charges for use of TM were significantly less (p<0.01) than comparable outpatient visits. (Abstract by: Author)

Transtelephonic arrhythmia monitoring (TTM) is an effective tool for detecting arrhythmias associated with infrequent symptoms. Other uses include the evaluation of variant angina and follow-up of patients with postmyocardial infarction and pacemakers. However, no clear data have been provided as to the optimal duration of TTM or its cost-effectiveness. Reiffel et al. found that 95% of patients making symptomatic calls or making a call in which an arrhythmia was documented did so within 5 weeks; most patients (70%) made their first symptomatic call within 1 week. The cost-effectiveness of the 5-week TTM was not addressed. Our current study was designed to evaluate the clinical usefulness of TTM and from that database to derive a strategy for its cost-effectiveness use. (Abstract by: Author)

Other


CONTEXT: Despite the common use of e-mail, little beyond anecdote or impressions has been published on patient-clinician e-mail consultation. OBJECTIVE: To report our experiences with free-of-charge e-mail consultations. DESIGN: Retrospective review of all e-mail consultation requests received between November 1, 1995, and June 31, 1998. SETTING AND PARTICIPANTS: Consecutive e-mail consultation requests sent to the Division of Pediatric Gastroenterology at the Children's Medical Center of the University of Virginia in Charlottesville. MAIN OUTCOME MEASURES: Number of consultation requests per month, time required to respond, who initiated the request and their geographic origin, and the kind of information requested in the consultation. RESULTS: During the 33-month period studied, we received 1239 requests, an average (SD) of 37.6 (15.9) each month. A total of 1001 consultation requests (81%) were initiated by parents, relatives, or guardians, 126 (10%) by physicians, and 112 (9%) by other health care professionals. Consultation requests were received from 39 states and 37 other countries. In 855 requests (69%), there was a specific question about the cause of a particular child's symptoms, diagnostic tests, and/or therapeutic interventions. In 112 (9%), the requester sought a second opinion about diagnosis or treatment for a particular child, and 272 consultations (22%) requested general information concerning a disorder, treatment, or medication without reference to a particular child. A total of 1078 requests (87%) were answered within 48 hours of the initial request. On average, reading and responding to each e-mail took slightly less than 4 minutes. CONCLUSION: E-mail provides a means for parents, guardians, and health care professionals to obtain patient and disease-specific information from selected medical consultants in a timely manner. (Abstract by: Author)


CONTEXT: The Internet is increasingly used by consumers to seek health and medical information, but online medical advice has not been explored systematically. OBJECTIVE: To explore the attitude of physicians and other providers of medical information on the Internet toward unsolicited e-mail from patients and their reaction to a fictitious acute medical problem described in such an e-mail. DESIGN: E-mail in December 1997 and January 1998 to Web sites from a fictitious patient describing an acute dermatological problem. Follow-up questionnaire survey to the same sites. SETTING: World Wide Web. SUBJECTS: Fifty-eight physicians and Web masters. MAIN OUTCOME MEASURES: Response rate and types of responses. RESULTS: Twenty-nine (50%) responded to the fictitious patient request; 9 respondents (31%) refused to give advice without having seen the lesion, 27 (93%)
recommended that the patient see a physician, and 17 (59%) explicitly mentioned the correct "diagnosis" in their reply. In response to the questionnaire, 8 (28%) of the 29 respondents said that they tended not to answer any patient e-mail, 7 (24%) said they usually reply with a standard e-mail message, and 7 (24%) said they answer each request individually.

CONCLUSIONS: Responses of physicians and Web masters to e-mail requests for medical advice vary as do approaches to handling unsolicited e-mail. Standards for physician response to unsolicited patient e-mail are needed. (Abstract by: Author)


OBJECTIVES: To describe the status of telemedicine in rural America, the characteristics of health care facilities using telemedicine technologies to serve rural patients, the volume and scope of services delivered, the costs associated with this care, and the funding sources. METHODS: A screening survey was mailed to all 2472 nonfederal U.S. hospitals located outside metropolitan areas. Nonrespondents were interviewed by telephone. Those who reported some form of telemedicine capability, and all the telemedicine affiliates they named, became the sample for a detailed follow-up survey (N = 558) in January 1996. RESULTS: Ninety-six per cent of all rural hospitals responded to the screener survey, and 89% of the 558 identified telemedicine facilities responded to the detailed follow-up survey (total respondents = 499). In this cross-sectional study, two thirds of the telemedicine respondents (340) were using only teleradiology. Of the 159 telemedicine programs pursuing other clinical applications, 67% had been using telemedicine for 2 years or less. Telemedicine facilities have tried many clinical specialty applications, the most common being radiology, cardiology, and orthopedics. At this early stage of technology diffusion, reported utilization of the telemedicine systems for both clinical and nonclinical applications was very low, and the unit costs of equipment acquisition and operating expenses were corresponding high. Programs most commonly used hospital financial resources and federal grants and contracts for support. Telemedicine networks planned to grow from an average of nine facilities to an average of 13 facilities during 1996. CONCLUSIONS: Investment has been rapid in telemedicine, and the installed base reported in this survey was large, sophisticated, and growing rapidly. Nonclinical uses of the technology (e.g., meetings, training sessions, continuing medical education) were more common than clinical consultations, although the volumes of both were quite low. Investment and expansion to new sites were occurring in the absence of a favorable payor reimbursement environment and in spite of low volume at most operating sites, demonstrating optimism about the future of telemedicine and the potential for nonclinical applications. (Abstract by: Author)


Although clinicians can now search the medical literature electronically from the clinic, bedside, or operating suite, little is known about the performance characteristics of online information services. Fourteen access routes to the MEDLINE database of journal literature were compared for retrieval quantity and quality, user and online search time, and cost for randomly ordered, standardized searches on common clinical problems. All routes produced the articles we judged to be the most definitive on the clinical problem. However, routes differed significantly (p less than 0.01) for the same searches with respect to online time (range, 5.15 to 18.72 minutes), total search time (8.37 to 20.55 minutes), cost (US $3.38 to $11.62), and proportion of articles relevant to the topic (98% to 75%). "User friendliness" aside, our results showed that the higher the cost, the worse the product. Clinicians should consider these major differences when deciding which search system to use. (Abstract by: Author)

As the federal administration advances the idea of the "information superhighway," many disciplines are being challenged to find ways to use advanced telecommunications to improve access to information, enhance learning opportunities, and achieve higher levels of international competitiveness. Telemedicine, the use of communications technology in the practice of medicine, may change the way rural health care is provided by improving access to medical information, diagnostic tools, and consultations. The information and health care services required by health care professionals are rapidly changing, and dissemination of this information to isolated practitioners has proven to be difficult. By providing support electronically from a central site, the most current information is more readily available. Using test-bed hospitals in rural and urban settings, the National Library of Medicine-funded National Laboratory for the Study of Rural Telemedicine at the University of Iowa is currently developing the necessary infrastructure to support targeted projects studying how telemedicine applications can be made more effective and readily available. (Abstract by: Author)


OBJECTIVE--To understand the ways in which computer-mediated searching of the biomedical literature affects patient care and other professional activities. Undertaken to determine the ways in which on-line access to the biomedical literature via the National Library of Medicine's MEDLINE database “makes a difference” in what physicians do when confronted with a medical problem requiring new or additional information. DESIGN--An adaptation of the Critical Incident Technique used to gather detailed reports of MEDLINE search results that were especially helpful (or not helpful) in carrying out the individual's professional activities. The individual physician was the source of the patient care incident reports. One thousand one hundred fifty-eight reports were systematically analyzed from three different perspectives: (1) why the information was sought; (2) the effect of having (or not having) the needed information on professional decisions and actions; and (3) the outcome of the search. PARTICIPANTS AND SETTING--Telephone interviews were carried out with a purposive sample of 552 physicians, scientists, and other professionals working in a variety of clinical care and other settings. Of these, 65% were direct users of MEDLINE throughout the United States, and 35% had MEDLINE searches conducted for them either at a major health sciences center or in community hospitals. RESULTS--Three comprehensive and detailed inventories that describe the motivation for the searches, how search results affected the actions and decisions of the individual who initiated the search, and how they affected the outcome of the situation that motivated the search. CONCLUSIONS--MEDLINE searches are being carried out by and for physicians to meet a wide diversity of clinical information needs. Physicians report that in situations involving individual patients, rapid access to the biomedical literature via MEDLINE is at times critical to sound patient care and favorably influences patient outcomes. (Abstract by: Author)


New types of telemedicine links are being tested in Ottawa and the definition they provide is so good that cardiologists can treat patients several hundred kilometers away. Dr. Wilbert Keon says this technology should not be seen as an expensive frill but as a needed advance that will make health care more efficient. (Abstract by: Author)

Telesurgery requires a network with the following characteristics: reliability; acceptable end-to-end delay; the ability to transfer data from sources with widely different data rates; low data error rates. A wide range of network options is currently available and even more will be available shortly. It is concluded that for telesurgery ISDN is the best option at present. In the near future, as they become available commercially. ATM networks are likely to be preferable. (13 Refs) (Abstract by: Author)


Reviews the telemedicine facilities and capabilities of the Virginia Telemedicine Program.


In spite of the many advances in technology, complex problems must be addressed in establishing and maintaining a telemedicine system. Although most such systems are built around interactive videoconferencing (IAVC) equipment, clinical requirements dictate that these systems offer more than traditional IAVC systems. Input from system users should be obtained early in the design process to ensure the functionality necessary to achieve maximum utilization. Surprisingly, audio, rather than video, signals may present the greatest challenge to achieving consistent, high-quality videoconferencing encounters. Audio technical problems can be frustrating for patients and providers alike and can undermine user confidence in IAVC as a vehicle for healthcare delivery. A capability for remote access and control of components at distant sites seems essential to providing cost-effective and technically reliable service.

**Reviews**

**Meta-Analysis**


The purpose of this study was to describe the magnitude of the relationships between nurses' job satisfaction and the variables most frequently associated with it. A meta-analysis of data from 48 studies with a total of 15,048 subjects revealed that job satisfaction was most strongly associated with stress (-.609) and organizational commitment (.526). Seven variables had correlations between .20 and .50: communication with supervisor, autonomy, recognition, routinization, communication with peers, fairness, and locus of control. Four other variables frequently included in these studies had low correlations (less than .20): age, education, tenure, and professionalization. The influence of employment site, date of study, and measures used on the size and consistency of estimates was described. (Abstract by: Author)


A meta-analysis was conducted on nine studies of an assertive outreach model for frequent users of psychiatric hospitals. Four studies used experimental or quasi-experimental designs and five used pre-post designs. Findings at one-year follow-up were examined for retention in community mental health services, psychiatric inpatient days, quality of life, and client level of functioning. Eighty-four percent of assertive outreach clients were still receiving
mental health services after one year, compared to 54% of controls. In two-thirds of the programs, the mean annual rate of inpatient days declined by 50% or more. The overall experimental effect size for quality of life was negligible, although changes over time for assertive outreach clinics were more encouraging. Similarly, improvement in level of functioning was found for assertive outreach clients. The study examining experimental differences in level of functioning obtained a non-significant moderate effect.


This meta-analysis examined how demand and resource correlates and behavioral and attitudinal correlates were related to each of the 3 dimensions of job burnout. Both the demand and resource correlates were more strongly related to emotional exhaustion than to either depersonalization or personal accomplishment. Consistent with the conservation of resources theory of stress, emotional exhaustion was more strongly related to the demand correlates than to the resource correlates, suggesting that workers might have been sensitive to the possibility of resource loss. The 3 burnout dimensions were differentially related to turnover intentions, organizational commitment, and control coping. Implications for research and the amelioration of burnout are discussed. (Abstract by: Author)


This study investigated the relative effectiveness of realistic job previews (RJPs) and job enrichment as turnover reduction strategies. A thorough literature search located 20 experiments (N = 6,492) dealing with attempts to reduce turnover in field settings. Several meta-analysis techniques were applied to these experimental studies. Results indicate that variation in the outcomes of job enrichment studies can be attributed to sampling error alone, whereas variation in the outcomes of RJP studies cannot. A search for moderators in the latter case revealed moderate support for the notion that task complexity affects RJP outcomes. Furthermore, the meta-analyses indicate that job enrichment interventions are about twice as effective in reducing turnover as RJPs, the former yielding an average phi coefficient of .17 and an approximate effect size (d) of .35. Based on the calculated effect sizes, estimates of savings from turnover reductions are provided.

Review


In medical technology assessment, randomized control trials (RCTs) play an important role in determining the relative efficacy of compared treatments. As scarce resources necessitate choosing among options for care, comparing costs of alternative tests, treatments, or programs also becomes important. This study assessed the prevalence and completeness of economic analyses in RCTs published from January 1966 through June 1988. It was found that only 121 of over 50,000 published randomized trials (0.2%) included economic analyses.


This article presents an overview of numerous economic analyses of various telemedicine applications, including calculating costs (fixed, direct variable and indirect variable

PURPOSE: To review the recommendations by the U.S. Panel on Cost-Effectiveness in Health and Medicine (panel) for use in future nursing research. The review (a) provides a critique of the nursing cost-effectiveness and cost utility literature from the perspective of the recommendations set forth by the panel and other recognized authorities in cost-effectiveness analysis (CEA), (b) constructs an interdisciplinary framework to show the steps in the conduct of CEA, (c) makes the techniques and major findings of nursing CEA studies available and understandable, and (d) offers guidelines for the incorporation of CEA into the evaluation of future nursing intervention and research.

DATA SOURCES: Seven nursing studies published between 1992 and 1996 that compared two or more interventions for costs and outcomes.

ORGANIZING FRAMEWORK: For each study, the (a) perspective, (b) net costs, (c) net effect, (d) analysis of costs and effects, and (e) decision outcomes were analyzed.

FINDINGS: If the panel's recommendations reflect the problems in the health care CEA literature in general, then on balance, the nursing CEA 1992-1996 studies are no more or less flawed than CEA studies in the health or medical care fields.

CONCLUSIONS: Methodologic guidelines and interdisciplinary strategies are needed to advance the progress of nursing cost-effectiveness research. (Abstract by: Author)


There is the expectation that outcomes research and the promulgation of medical practice guidelines will be able to identify and hopefully reduce the amount of unnecessary or inappropriate medical care through a variety of methods, including utilization review. However, past efforts by public and private insurers to deny claims on the basis of formal technology assessments or practice guidelines have frequently been overturned by the courts for multifarious reasons. This paper examines the court's reluctance to accept a variety of technology assessment methods in coverage policy decisions. The paper reviews the options that have been proposed to restrict judicial involvement in the formulation of coverage policy and then proposes a new option that employs a more precise taxonomy of medical practice assessment. (Abstract by: Author)


This issue includes articles concerning: Telcos promote TM capabilities; HTR's Industry Activity Tracker; ATP uses "First Class" as basis of CHIN; The Elmendorf Example; Three-stage Alaskan roll-out; and that ATP will lead to "permanent change" in delivery.


The objective of this study was to analyze the extent of reporting of sensitivity analyses in the health economics, medical and pharmacy literature between journal types and over time. Despite the fact that all published pharmaceconomic guidelines suggest the use of sensitivity analysis, only 59% of studies between 1989 and 1993 did so. Improvement is required, especially in the pharmacy literature. No time trends in the conduct of sensitivity analyses were detected. Pharmaceconomic guidelines should provide more details on preferred methods of sensitivity analysis and on desired parameters.

Traditional quantitative risk assessment based on conservative generic assumptions led to an upper-bound risk value with minimum or no consideration of costs and benefits. There is a growing consensus for a new approach to risk assessment based on a combination of scientific risk assessment and economic cost-benefit analysis. Scientific evaluation would be improving to support the economic cost-benefit analysis. The objective is to demonstrate whether the benefits justify the costs. The move in the new direction is shown by Executive Order 12866 and the Office of Management and Budget implementing document, the proposed regulatory reform legislation in Congress, the draft report of the Risk Assessment and Risk Management Commission, and the Safe Drinking Water Act Amendments of 1996 that enacted the new approach combining scientific and economic assessment of risk. This Commentary discusses these developments with particular reference to contemplated changes in scientific risk assessment to support a parallel economic risk-benefit analysis. (Abstract by: Author)


Despite the growing literature on economic evaluation of health care programs, little attention has been paid to the theoretical foundations of cost-effectiveness and cost utility analyses and the validity of the decision rules adopted as methods of achieving the stated goals. We show that although applications of the techniques can be used to pursue some managerial objectives in the context of highly constrained environments, such applications are inconsistent with both welfare economic objectives and the interpretations of the findings of these applications. Alternative strategies are identified as potential and practical methods for pursuing welfare economic objectives. (Abstract by: Author)


Over the last decade there has been tremendous interest in economic evaluations of healthcare programs, especially in the pharmaceutical field. Economic evaluations started about 30 years ago as rather crude analyses, in which the value of improved health was measured in terms of increased labor production. Now, more refined methods are available to measure health changes in terms of quality-adjusted life-years gained or willingness to pay. It is important to continue this development, and major fields for future work include the incorporation of quality-of-life measurements into economic evaluations and the linking of cost-effectiveness and cost-benefit analyses into a unified framework of economic evaluation. How to incorporate distributional issues is another important area. Finally, it seems crucial to further explore the link between economic evaluation and decision making, since the purpose of economic evaluations is to affect decision making. (Abstract by: Author)


OBJECTIVE: To assess and compare the quality of economic studies in selected pharmacy, medical, and health economics journals. DATA SOURCES: DICP The Annals of Pharmacotherapy, American Journal of Hospital Pharmacy, Hospital Pharmacy, New England Journal of Medicine, Medical Care, Journal of the American Medical Association, PharmacoEconomics, International Journal of Technology Assessment in Health Care, and Journal of Health Economics using MEDLINE, EMBASE, and International Pharmaceutical Abstracts. Search terms included “economic,” “cost,” and “cost analysis.” STUDY SELECTION:
Reviewers appraised abstracts to identify original research published during 1989-1993 comparing costs and outcomes between drugs, treatments, and/or services. Initially, 123 articles met criteria; 16 were inappropriate, 17 were randomized out, and 90 (73%) were used (30/group). DATA EXTRACTION: Quality was assessed using a 13-item checklist. Interrater reliability was 0.91 (p < 0.05) for 9 raters, test-retest reliability was 0.94 (p < 0.001). DATA SYNTHESIS: A 2-way ANOVA, with overall quality scores as a dependent variable with journal type and year as independent variables, was significant (F = 2.79, p = 0.002, r² = 0.34), with no significant interaction (F = 0.71, p = 0.68) or time effect (F = 0.70, p = 0.60). Journal types differed; pharmacy journals scored significantly lower (chi² = 53.89, df = 2, p < 0.001). Items rated adequate (i.e., correct or acceptable) increased over time (chi² = 21.18, df = 4, p < 0.001). Ethical issues and study perspective most needed improvement. CONCLUSIONS: Article quality for all journal types increased over time nonsignificantly; health economics journals scored highest, then medical journals, with pharmacy journals significantly lower (and having the highest standard deviation). We recommend that authors and reviewers pay closer attention to study perspective and ethical implications. (Abstract by: Author)


This report on the pharmaceutical industry will be published in two parts. Part I begins with a summary of the study and its conclusions. The authors then provide an overview of the characteristics of the industry and current trends in its growth and structure: production and consumption, employment, research and development, capital investment, firm and product concentration and product competition, and pricing. A discussion of international trade follows, covering intra- and inter-regional, intra-firm, and intra-industry trade. The report will continue in the next issue of the Journal (Part II) with a look at foreign direct investment, inter-firm networks, and governmental policies. (Abstract by: Author)


A literature review explored methodologies by which cost effectiveness and economic impact of various critical care procedures are measured. "Unit of analysis" comparisons of cost effectiveness, cost-benefit, and cost-utility analyses in terms of costs, benefits, and summary measures were also considered.


Turnover is especially critical in nursing homes: continuity of care and personal relationships between care-givers and residents are important determinants of quality of care. Additionally, for the cognitively impaired nursing home resident, constant change of staff is bound to aggravate disorientation. Research demonstrates links between turnover and employment/employee characteristics and employment availability. (Abstract by: Author)


The increasing number of economic evaluations of healthcare interventions, and of drug therapies in particular, has been well documented. However, surveys have demonstrated that standards of conduct of such studies have not similarly increased. Of particular concern is the lack of development or even consideration of statistical techniques in the reporting of studies. This article addresses issues that must be considered both in the conduct and in the assessment of the quality of studies. Throughout the paper, examples of pharmacoeconomic analyses are used to illustrate the points made. Recommendations for the conduct of future
pharmacoeconomic studies are given. Such recommendations specifically relate to the level of testing that is conducted, the choice of statistical tests and the manner in which statistical significance is reported. In addition, existing methods for the statistical analysis of cost-effectiveness ratios and for the determination of sample size in economic evaluations are discussed, and a partial solution to this issue is offered. (Abstract by: Author)


This article reviews the methods of economic evaluation of health technology. The different forms of evaluation are outlined and the importance of assessing costs and benefits at the margin stressed. The approaches used by economists to analyze priorities for health technologists are discussed and a number of key managerial and policy issues identified. It is concluded that, while further methodological improvements can be made, a clear methodology for economic evaluation of health technologies has been established. However, attention needs to be paid to the timeliness and relevance of economic evaluation in order to ensure its maximum impact.


Prior to 1989, physicians’ real income consistently increased at a rate greater than that of average US workers. Low Medicaid fees do not seem to limit access to at least a minimum of care. Many payers other than Medicare are adopting the resource-based relative value scale.


Seventy-five percent of physicians had at least one managed care contract in 1993. Recent studies have evaluated the savings claimed by managed care, and a majority have found that savings were due, at least in part, to enrollment of a healthier population. In general, differences in outcomes in managed care and fee-for-service care are small or nonexistent. (Abstract by: Author)


Cost-benefit (CBA) and cost-effectiveness analyses (CEA) are methods that enumerate the costs and consequences associated with health-related technologies, services, and programs. This article examines the trends in published CBA and CEA of personal health services from 1979 through 1990. It is based on a bibliography that was compiled to help address the immense need for information on the variation and effectiveness of medical practices, particularly as researchers expand their analysis to a study of the cost effectiveness of medical and surgical interventions, health care technologies, preventive practices, and other health programs. A systematic search was conducted for all articles under the heading "cost-benefit analysis" (which includes cost-effectiveness analysis) and "costs and cost analysis." Data sources included the MEDLARS (National Library of Medicine) database, other bibliographies in specialized areas, reference lists in key articles, and contacts with researchers in the field. All titles and abstracts were scanned to determine if the articles pertained to personal health services and if both costs and consequences were assessed. If both criteria were met, the article was included in the bibliography. This search resulted in 3,206 eligible CBA/CEA publications from 1979 through 1990. The publications were subdivided into two major categories: reports of studies and "other" publications, including reviews, descriptions of methodology, letters, and editorials. Reports of studies and "other" publications were classified into approximately 250 different topic areas. The studies were further classified by parameters, such as study type, publication vehicle, and medical function. This article describes the results of this classification and describes trends during 1979 to 1990 compared with 1966 to 1978.
The classification of study reports and "other" publications into 250 topic areas is presented in Appendix A. The entire bibliography is reproduced in Appendix B. Detailed tables of findings are presented in Appendix C, and the results are illustrated graphically in Appendix D. Appendix E provides the coding scheme used in the bibliography's data base. (Abstract by: Author)


The use of expert opinion in pharmacoeconomic studies is widespread. A review of the relevant literature has shown that expert opinion is frequently used in decision analysis, Markov models, and disease management, with estimates of potential values derived from Delphi panels, modified Delphi panels, and expert round tables. These consensus-gathering methods are often applied as if potential drawbacks to their application were absent. This article reviews and summarizes the use of these techniques in pharmacoeconomic research and evaluates the potential shortcomings of the methodology employed. In particular, several areas of concern are noted: the provision of baseline information or seed algorithms to panelists, the high attrition rate of panels, the criteria for selecting experts and the definition of consensus. This article offers recommendations for the future application of these techniques and concludes that expert opinion can still play a valuable role in pharmacoeconomic research. (Abstract by: Author)


Because of interest in cost containment, a series of basic guidelines for performing cost-effectiveness research has evolved in the past decade. These guidelines advise that the perspective of the cost study be clarified, that all approachable costs, benefits, and health outcomes be included, and that the discounting and sensitivity analyses be performed where appropriate. A survey of 47 recent cost effectiveness publications selected via MEDLINE and manual searches confirm our hypothesis that many studies do not adhere to these guidelines. Since such shortcomings can lead to misleading or ill founded conclusions, attention must be paid to the principles of cost effectiveness research to avoid making major, inappropriate health policy decisions.


Provides a review of cost analyses in obstetrics and gynecology.


Guidelines for health economics research are being developed around the world by academic groups, government organizations, and consultants. As reviewed in this paper, there are many similarities that will enable some comparison across countries. There are also important differences in the guidelines that may prevent comparability across studies. As guidelines are being developed, there needs to be a coordinated effort among various developers to ensure that guidelines are applicable in various settings, that the science is not stifled, and that the guidelines provide benefit to those ultimately impacted, the patients.


This review concludes that the best way to root out waste in the system is to apply, with appropriate caution, cost-effectiveness analysis.

Cost-effectiveness analysis, an analytic tool that expresses as a ratio the cost of obtaining an additional unit of health outcome, can help decision makers achieve more health protection for the same or less cost. We characterize the state of the cost-effectiveness analysis literature by reviewing how this technique is applied to various clinical and public health interventions. We describe the results of cost-effectiveness analyses for over 40 interventions to reduce cancer, heart disease, trauma, and infectious disease. The cost-effectiveness ratios for these interventions vary enormously, from interventions that save money to those that cost more than $1 million per year of life gained. The methods used to derive the cost-effectiveness ratios also vary considerably, and we summarize this variation within each health area. Greater uniformity of analytical practice will be necessary if cost-effectiveness analysis is to become a more influential tool in debates about resource allocation. (Abstract by: Author)


This article discusses the cost effectiveness of the U.K. health care system.


This article provides a review of the future of telemedicine


The contribution of medical technologies to the rising costs of health care is generating increasing enthusiasm for application of methods for assessing the impact of the technologies on health care cost and quality. Various assessment methods are available, ranging from rigorous Randomized Controlled Clinical Trials to informal Opinion Surveys of practitioners experienced with the technologies. Between these extremes are techniques such as Performance Analysis, Case Series, Case Studies, Meta-analysis and Consensus Development. In the United States several institutions are involved in the technology assessment process. These institutions include government agencies, third-party carriers, advisory groups, and professional organizations. Currently these institutions emphasize variables such as safety, effectiveness and, less frequently, cost-effectiveness as criteria of technology assessment. However, outcome measures such as morbidity and mortality statistics and ‘quality of life’ parameters are receiving increased attention as more penetrating criteria for technology assessment. (Abstract by: Author)

Our objective was to assess the quality of reporting of original economic research articles in Pharmacoeconomics from inception to the end of 1995, in order to identify areas of strength and weakness, and analyse trends over time. Each regular issue of the journal was examined for original economic evaluations. Accepted articles were categorised by study type and by year of publication. A previously developed 13-item quality-scoring checklist was applied. The maximum possible score that an article could be assigned was 4.0. Quality scores were analysed over time and by study type. 54 articles were identified for analysis. Mean overall score (OS) ranged from a minimum of 1.80 to a maximum of 3.75, with a mean OS of 3.01 [standard deviation (SD) = 0.47]. The item with the highest mean score was the 'definition of study aim' (mean OS = 3.46, SD = 0.69). The item with the lowest score was 'ethical problems discussed and identified' (mean OS = 1.44, SD = 0.92). Only 4 items on the checklist had mean scores lower than 3.0. No significant time trend was apparent for OS (R2 = 0.002). Cost-benefit (mean OS = 3.25, SD = 0.85, n = 5), cost-effectiveness (mean OS = 3.11, SD = 0.97, n = 27), and cost-utility (mean OS = 3.29, SD = 0.93, n = 6) analyses had mean scores significantly higher than cost-analysis/cost-of-illness studies (mean OS = 2.51, SD = 1.14, n = 8). The mean OS for cost-minimisation studies was 2.74 (SD = 0.49, n = 8). Despite some weaknesses in particular aspects of economic evaluations published in Pharmacoeconomics, we conclude that the journal has offered publications with acceptable overall quality and adequate methodology. (Abstract by: Author)


We have reviewed 4 international sets of guidelines for the economic evaluation of pharmaceutical products-those of the Australian Pharmaceutical Benefits Advisory Committee, the Canadian Coordinating Office for Health Technology Assessment, the Ontario Ministry of Health, and the England and Wales Department of Health. Comparison of these guidelines reveals that there are a number of differences between them, including disparities in outcome selection, costs and perspectives. These observations were attributed to differences in study purpose, conceptual approach, measurement techniques and value judgements. Uniformity can be achieved only in conceptual approach and measurement technique. Guidelines should be flexible to accommodate differences in the study purposes and value judgements of the analysts. (Abstract by: Author)


Scientific reviewing methods were applied to economic model of influenza vaccination was developed from these primary sources. Issues arising from the secondary literature review include the quality of evidence on the effectiveness of the vaccines, the absence of a traditional population-based approach to reviewing economic data, confusion in terminology, and how to generalise from resource data contained in primary evaluations. Data from the literature review were summarised in terms of resource units used in the prevention and treatment of influenza. An economic model was constructed using local unit costs (from the Emilia region of Italy) and applying the data to a notional population. The model was sensitive to length of stay in hospital but not to variation in incidence of influenza, days off work or number of medical consultations. The model was predicated on and is sensitive to an estimate of 80% vaccine effectiveness. The approach is constrained by the available data, but could be more generally useful in that it allows variations in the quantity of inputs to be considered separately from variations in their
values. The model may be used locally as a decision-making tool, although the method needs further development. (Abstract by: Author)


A review that suggests that much of the skepticism of cost-benefit analysis of health interventions is not well-founded.


In randomized controlled trials, screening mammography has been shown to reduce mortality from breast cancer about 25% to 30% among women aged 50 to 69 years after only five to six years from the initiation of screening. Among women aged 40 to 49 years, trials have reported no reduction in breast cancer mortality after seven to nine years from the initiation of screening; after 10 to 14 years there is a 16% reduction in breast cancer mortality. Given that the incidence of breast cancer for women aged 40 to 49 years is lower and the potential benefit from mammography screening smaller and delayed, the absolute number of deaths prevented by screening women aged 40 to 49 years is much less than in screening women aged 50 to 69 years. Because the absolute benefit of screening women aged 40 to 49 years is small and there is concern that the harms are substantial, the focus should be to help these women make informed decisions about screening mammography by educating them of their true risk of breast cancer and the potential benefits and risks of screening. (Abstract by: Author)


Do economic theories that underlie discounting have specific implications for program evaluation in health? In this study, both the contemporary practice and the theoretical foundations of discounting are reviewed. The social discount rate controversy is considered, and the two major concepts (i.e., opportunity cost and time preference) involved in the formulation of a social discount rate are outlined. Also described are the arguments for discounting proposed by thinkers in non-economic disciplines. Finally, the implications of choosing a discount rate for evaluation of individual health care programs are considered. It is argued that the conventional practice of discounting all health care programs at a rate of 5% may not consistently reflect societal or individual preference. Specific recommendations arising from this paper are: 1) given the considerable disagreement at the theoretical level as to the appropriate social discount rate, analysts should be specific about what theoretical approach underlies their choice of rate, especially when the analytic result is sensitive to the discount rate; 2) the discount rate chosen should be appropriate for the perspective of the analysis (social vs. individual vs. institutional, etc.); 3) when appropriate, measures should be taken to avoid double discounting, because some health related outcome measures already incorporate individuals’ time preference; and 4) it is suggested that the political process may serve as the appropriate means of reflecting social values in the choice of a discount rate. In addition, the authors argue that a consensus conference approach, with political participation, offers a flexible, pragmatic, and explicit way of synthesizing the empirical, normative, and ethical considerations that underlie choice of a discount rate. (Abstract by: Author)


This review discusses the general and evolving methodology of cost-effective analysis as well as provide a glossary of terms.
Review of the current and future utilization of telemedicine in trauma care.

In a recent issue of Clinical Therapeutics, Dr. Michael F. Drummond argued that the future of pharmacoeconomics "lies in developing both trial-based and modeling studies, and in meeting the needs of decision makers". The purpose of this commentary is to present an alternative scenario. The future of pharmacoeconomics lies in meeting the needs of decision-makers; if these needs are to be met, the modeling of new drug impacts becomes the principal task of the pharmacoeconomist. Clinical trials, while important in meeting the safety and efficacy requirements of regulatory bodies such as the US Food and Drug Administration, are, by their very nature, only an input to the modeling of the impact of new therapies on the costs and outcomes of treating patients within health care systems. While this may be seen—particularly from a clinical paradigm—to be an heretical view, it is the one that I believe will prevail if pharmacoeconomics is to survive as a viable and meaningful discipline. (Abstract by: Author)

Reviews the results from several preliminary telemedicine trials to offer support the use of telemedicine in the ER.

An introduction to the theory and practice of clinical decision analysis, including decision trees and rudimentary cost-effectiveness calculations. A brief review of several published articles is also included. (Abstract by: Author)

The varied interpretations of the term "cost-effective" in the pharmacy literature are discussed and the soundness of pharmacoeconomic analyses is assessed. Sixty-five studies concerning cost issues, which were published by six pharmacy journals from January 1985 to December 1990, were evaluated according to 10 methodological criteria. Two investigators independently reviewed each study and completed a data collection form; differences were discussed and resolved to ensure consistency of evaluation. In 36 (55%) of 65 articles, cost-effectiveness was misinterpreted as cost saving. Only 3 of the 10 criteria were fulfilled by 50% or more of the studies evaluated. Problem areas included the following:
1. identification of relevant costs and consequences of each strategy; 2. discounting--adjusting data to reflect the differential timing of costs and consequences; 3. incremental analysis--examining extra costs of a program relative to additional effects provided; 4. sensitivity analysis. Many pharmacoeconomic studies inappropriately used the term "cost-effective" and inadequately addressed basic methodological components of an economic evaluation.

We review 1980s research on American rural hospitals within the context of a decade of increasing restrictiveness in the reimbursement and operating environments. Areas addressed include rural hospital definitions, organizational and financial performance, and strategic management activities. The latter category consists of hospital closure, diversification and
vertical integration, swing-bed conversion, sole community provider designation, horizontal integration and multihospital system affiliation, marketing, and patient retention. The review suggests several research needs, including: developing more meaningful definitions of rural hospitals, engaging in methodologically sound work on the effects of innovative programs and strategic management activities—including conversion of the facility itself—on rural hospital performance, and completing studies of the effects of rural hospital closure or conversion on the health of the communities served. (Abstract by: Author)


Despite the considerable burden and costs of illness and despite the increasing need to set priorities on the basis of efficiency considerations, only 20 economic appraisals of asthma and COPD care have been published during the past 11 years. This paper provides a detailed summary of the cost-effectiveness 'evidence' given by these studies and a discussion of relevant methodological issues. The studies comparing programme costs of delivery methods for oxygen and for aerosol bronchodilator drugs, provide the most straightforward evidence in favour of the concentrator and the metered dose inhaler respectively. There also seems to be evidence in favour of hospital-based home care programmes as compared to community-based home care programs. Health education, especially directed at asthmatic children seems to reduce health care costs and improve attitude, compliance behaviour and self-management skills. Information on the cost-effectiveness of pharmacotherapy and diagnostic technologies, both important interventions in asthma and COPD, was found to be totally lacking. (Abstract by: Author)


This article presents a review of health economic issues and challenges that need to be addressed by the state of India to ensure better public health.


OBJECTIVES: The objectives of this study were to examine variations in the methods used by researchers to estimate QALYs in published cost-effectiveness analyses, and to investigate whether the methods have improved over time. DATA AND METHODS: Using a MEDLINE search, the authors identified 86 original cost-effectiveness analyses, published between 1975 and 1995, that used QALYs as the measure of effectiveness. For each study, they recorded the health-state classification system, the source of the preference weights, the measurement technique, and the discount rate. The methods used were compared with the recommendations of the U.S. Panel on Cost-Effectiveness in Health and Medicine. RESULTS: Only 20% of the studies used "generic" health-state classification systems (e.g., health utilities index); 21% relied on community-based weights; 40% used formal measurement techniques (e.g., time-tradeoff method); and 88% discounted both future costs and QALYs. There was little evidence that methods had improved over time. CONCLUSIONS: The results illustrate extensive variation in the construction of QALYs in cost-effectiveness analyses and reveal that most studies have not adhered to practices now recommended by leaders in the field. There is a need for more methodologic rigor and consistency if the results of such studies are to be compared and used for purposes of allocating resources (Abstract by: Author)

An increasing number of economic appraisals are published and (to a much lesser degree) used when advocating a particular (screening programme or (even more rarely) for actual decision making. At least a superficial knowledge of the scope of economic appraisals is, therefore, necessary, with an understanding of what kind of information and data are used. This article focuses mainly on providing such an overview, with warnings about the pitfalls of the interpretation and use of such analyses. (Abstract by: Author)


To evaluate economic analyses and determine their value for clinical practice, the reader must have a clear understanding of how these analyses are performed and how the results can be applied to clinical practice. This second article in the "Primer on Economic Analysis for the Gastroenterologist" focuses on the critical assessment of economic evaluations in the gastrointestinal literature. OBJECTIVES: The purpose of this article is (1) to review the criteria for the critical appraisal of an economic analysis, and (2) to apply these criteria to two recent articles that examine the cost-effectiveness of screening for hemochromatosis. METHODS: The criteria for the critical appraisal of an economic analysis are outlined. To demonstrate the application of these criteria to the gastroenterology literature, they are used to evaluate two recent articles that examine the cost-effectiveness of screening for hemochromatosis. SUMMARY/CONCLUSIONS: The reader of economic analyses in the gastroenterology literature is provided with a framework for the evaluation of such analyses and how they apply to gastroenterology. A systematic method for examining economic analyses and determining their value for the reader is illustrated. (Abstract by: Author)


Attempts to perform economic reviews of randomized controlled trials frequently lack a systematic approach. This conclusion is consistent with the findings of previous analyses of review articles in other fields, which have highlighted the failure to apply the same degree of rigor to this type of research synthesis that the scientific community has come to expect from primary research articles. (Abstract by: Author)


The changes brought about by managed care in America’s urban communities will have profound effects on rural physicians and hospitals. The rural health care market characterized by small, independent group practices working with community hospitals is being offered affiliations with large, often urban-based health care organizations. Health care is evolving into a free market system characterized by large networks of organizations capable of serving whole regions. Rural provider-initiated networks can assure local representation when participating in the new market and improve the rural health infrastructure. Although an extensive review of the literature from 1970 to 1996 reveals little definitive research about networks, many rural hospitals have embraced networking as one strategy to unify health care systems with minimal capitalization. These networks, now licensed in Minnesota and New York, offer rural physicians the opportunity to team up with their community hospital and enhance local health care accessibility. (Abstract by: Author)

Despite the considerable burden and costs of illness and despite the increasing need to set priorities on the basis of efficiency considerations, only 20 economic appraisals of asthma and COPD care have been published in the past 11 years. This paper provides a detailed summary of the cost-effectiveness "evidence" given by these studies and a discussion of relevant methodological issues. The studies comparing program costs of delivery methods for oxygen and for aerosol bronchodilator drugs, provide the most straightforward evidence in favor of hospital-based home care programs as compared to community-based home care programs. Health education, especially directed at asthmatic children seems to reduce health care costs and improve attitude, compliance behavior and self-management skills. Information on the cost-effectiveness of pharmacotherapy and diagnostic technologies, both important interventions in asthma and COPD, was found to be totally lacking.


OBJECTIVE: To review the fundamental concepts used in clinical economic analysis and establish a simple model to systematically evaluate the quality of pharmacoeconomic studies. DATA SOURCES: A MEDLINE search was used to identify pertinent pharmacoeconomic literature, including reviews. STUDY SELECTION: Selected literature evaluating the methodology of health economics studies was used. CONCLUSIONS: The number of studies presenting a pharmacoeconomic evaluation has increased progressively; however, the quality of the studies has not improved in parallel. The existence of different types of pharmacoeconomic studies does not justify their arbitrary use and the achievement of valid conclusions must be based on sound knowledge of the concepts employed, as well as on use of the most adequate tool in each instance. By evaluating pharmacoeconomic studies systematically, the more common errors (i.e., in planning the study or interpreting the results) can be detected and thus prevented. The checklist we present has 12 sections, each of which includes several subsections. After evaluating the corresponding subsections, each section is labeled as "correct," "acceptable," "doubtful," "incorrect," or "not applicable." From this qualitative evaluation, aspects that have been dealt with correctly and those needing improvement will become apparent. Also, the checklist permits the user to verify whether the results have been correctly obtained and, therefore, whether the conclusions are valid. The use of a checklist for evaluating pharmacoeconomic studies may be useful for researchers, journal editors, and the audience when performing, receiving, reading, or accepting a clinical economic study. (Abstract by: Author)


OBJECTIVE: To evaluate the methodology of the cost-effectiveness and cost-benefit literature in obstetrics and gynecology. DATA SOURCES: We performed a MEDLINE search of the general and subspecialty obstetrics and gynecology journals for the years 1990 through 1996. METHODS OF STUDY SELECTION: Original investigations including cost-effectiveness or cost-benefit were evaluated by two reviewers for adherence to ten minimum methodologic standards derived by a review of guidelines for medical economic analyses. The major criteria considered included: 1) provision of comparative options, 2) statement of analytic perspective, 3) presentation of cost data, 4) identification of outcome measure, 5) use of summary measure of economic effectiveness or benefit, and 6) performance of a sensitivity analysis. The minor criteria evaluated included: 1) statement of source of cost data, 2) inclusion of long-term costs, 3) use of discounting, and 4) calculation of an incremental summary measure. TABULATION, INTEGRATION, AND RESULTS: Ninety-eight articles that included cost-benefit or cost-
effectiveness analyses were identified. The mean number of major and minor principles adhered to were 3.6 and 1.0, respectively. Five publications (5.1%) conformed to all ten major and minor criteria, whereas nine (9.2%) articles used all six major criteria. The provision of cost data (94.8%) and statement of comparative options (96.9%) were the major principles most frequently adhered to, whereas the use of discounting (10.2%) and statement of analytic perspective (19.3%) showed the lowest compliance. Agreement between the reviewers was excellent (kappa .87). CONCLUSION: Published economic analyses in the obstetrics and gynecology literature seldom adhere to all recommended methodologic guidelines. Further training in the methodology of cost-effectiveness analysis is needed within the specialty. (Abstract by: Author)


OBJECTIVE: To determine whether published cost-effectiveness and cost-benefit analyses have adhered to basic analytic principles. DESIGN: Structured methodologic review of published articles. STUDY SAMPLE: Seventy-seven articles published either from 1978 to 1980 or from 1985 to 1987 in general medical, general surgical, and medical subspecialty journals. MAIN OUTCOME MEASUREMENTS: Articles were reviewed to assess the use and reporting of six fundamental principles of analysis. These principles were derived by reviewing widely cited textbooks and articles describing the methods for performing economic analyses and by selecting the methods universally recommended. MAIN RESULTS: Overall performance was only fair. Three articles adhered to all six principles, and the median number of principles to which articles adhered was three. Among the problems noted were failure to make underlying assumptions explicit and, therefore, verifiable, and failure to test assumptions with sensitivity analyses. No improvement in performance was observed between 1978 and 1987. Articles in general medical journals, however, were more likely to use analytic methods appropriately than articles in the general surgical or medical subspecialty literature. CONCLUSIONS: Greater attention should be devoted to ensuring the appropriate use of analytic methods for economic analyses, and readers should make note of the methods used when interpreting the results of economic analyses. (Abstract by: Author)


Concern about the escalating costs of health services is reflected in the rapid growth of the literature on cost-benefit and cost-effectiveness analysis (CBA and CEA, respectively) in health care. A search of that literature for 1966–78 produced a bibliography of more than 500 relevant references, growing from half a dozen per year at the beginning of the period to close to 100 each of the most recent 2 years. The literature growth has been more rapid in medical than non-medical journals and a preference for CEA over CBA appears to be emerging. Studies related to diagnosis and treatment have gained in popularity, while the early prominence of studies with a substantive prevention theme has diminished. Consistent with the increasing medical focus of the literature, numbers of articles oriented toward individual practitioner decision making have grown more rapidly than those oriented toward organizational or societal decision making. In addition to documenting these trends, this article identifies
published reviews of health care CBA/CEA and books and articles attempting to convey the principles of CBA/CEA to the health care community. The article concludes with speculation on likely near-future trends in the literature and consideration of the quality implications of the rapid growth. (Abstract by: Author)


OBJECTIVES: To assess whether health-care related economic evaluations labeled as "cost benefit analyses" (CBA) meet a contemporary definition of CBA methodology and to assess the prevalence of methods used for assigning monetary units to health outcomes. DATA SOURCES: Medline, Current Contents, and HSTAR databases and reference lists of review articles, 1991-1995. STUDY SELECTION: Economic analyses labeled as CBAs were included. Agreement on study selection was assessed. STUDY EVALUATION: CBA studies were classified according to standard definitions of economic analytical techniques. For those valuing health outcomes in monetary units (bona fide CBAs), the method of valuation was classified. RESULTS: 53% of 95 studies were reclassified as cost comparisons because health outcomes were not appraised. Among the 32% considered bona fide CBAs, the human capital approach was employed to value health states in monetary units in 70%. Contingent valuation methods were employed infrequently (13%). CONCLUSIONS: Studies labeled as CBAs in the health-care literature often offer only partial program evaluation. Decisions based only on resource costs are unlikely to improve efficiency in resource allocation. Among bona fide CBAs, the human capital approach was most commonly used to valuing health, despite its limitations. The results of health-care related CBAs should be interpreted with extreme caution. (127 Refs) (Abstract by: Author)

Editorial


Letter to Editor.


Editorial.


Letter to editor discussing health service decision-making in New Zealand's health care system.


Editorial.


Editorial.
   Editorial.

   Though biomedical ethics has only recently been recognized as a major new medical field, the connection between the practice of medical professionals and the ethics of medical practice dates back to the beginning of Western medicine. More recently, ethics has become more and more involved with economics. (Abstract by: Author)

   Editorial.

   Editorial.

   Editorial with comment.

   Letter to Editor.

   Letter to Editor.

   Editorial.

   Editorial.

   Letter to Editor.

   Letter to Editor.

   Letter to Editor.
Concerns regarding quality of care, combined with financial constraints, have fostered the growth of health economic analyses. The accompanying cost-effectiveness analysis of intraportal adjuvant chemotherapy by Messori et al. illustrates the strengths and limitations of health economic investigations. The reader of cost-effectiveness studies must examine the relevance and perspective of the cost data, the accuracy and generalizability of the assumed clinical benefits, and the relationship of the investigated treatment strategies to standard clinical practice. As clinicians learn to interpret health economic analyses and other forms of outcomes-based research, unnecessary expenditures will be avoided and the quality of care will improve.


Editorial.
Letter to Editor.

Other

This article presented the proceedings from the Second Invitational Consensus Conference on Telemedicine and the National Information Infrastructure held in Augusta, GA May 2-4, 1995.


This article contains an annotated bibliography and a standard bibliography listing articles that deal with telemedicine.

This article contains an annotated bibliography and a standard bibliography listing articles that discuss various aspects of telemedicine.

This article contains an annotated bibliography and a standard bibliography listing articles that deal with telemedicine.

This article contains an annotated bibliography and a standard bibliography listing articles that deal with telemedicine.

Editor's Note: At RWJF's October Board of Trustees meeting, staff gave a synopsis of some trends in demographics, economics, science and medicine and described the potential impact of these trends on our country's health care system and the health of its people.

The task of nursing administration is to make resources productive. The challenge is, therefore, to contain costs and meet the demands to maximize productivity without jeopardizing the quality of care. Nursing administration must work smarter and take advantage of opportunities to offer new direction, effect needed innovations in nursing, and enter into a more active leadership role in strategic, long term, and program planning.

Drug cost projections for 1998, factors that directly influence drug costs, and tools for projecting drug expenditures are discussed. The producer price index indicates that prices for drugs and pharmaceuticals increased 2.1% between January and June 1997; the increase for prescription preparations was 2.7%. Medi-Span data show an average increase for all drug products of 1.02% during the first six months of 1997; First Data-Bank reports a 1.7% increase for the same period. IMS America data, which take account of weighting for individual drugs or drug classes, show the prices of all drugs increasing 2.3% between the second quarters of 1996 and 1997. Drug industry analysts project the overall price increase in the next 12 months at 2-4%. Group purchasing organizations predict an average increase over the next 12 months of 0.56% for contracted drugs and 3.6% for noncontracted drugs. Various health care provider indexes suggest that increases in drug costs could be smaller over the next few years. The current trend of takeovers and mergers of pharmaceutical companies and health systems is likely to continue into 1998. As a result of generic competition and the loss of patent protection for many pharmaceutical products, the number of drugs to be introduced onto the market and the number of drugs in development are expected to escalate until the year 2000. These and other major changes in the health care environment, including changes in drug distribution and controversies over the use of formularies, will make future forecasting difficult. Compared with previous years, smaller increases in drug costs have been projected for 1998 and beyond, but changes in the health care environment mean that greater knowledge will be required to forecast future drug expenditures. (Abstract by: Author)


Attributes of the good physician: intelligence, compassion and courage. The students already possess these traits, just as the Scarecrow, Tin Man and Lion did before they set out for Oz, but they may dissolve in education systems that still decree that the initiation to medicine involve tonnes of tutored words and consuming call schedules. (Abstract by: Author)


Comprehensive bibliography of articles dealing with telemedicine from Jan. 1966 through March 1995 (1634 Citations).


This article presents a dialogue of an interview by Karen Gardner of Jack Taylor, chairman of the governing board of a rural hospital in IL.
ALPHABETICAL LISTING


Original article

A method for identifying comparison counties: application to a rural telemedicine evaluation project

L L Hicks, S E Koenig, K E Boles, R W Madsen, B W Kling, J A Mitchell, W D Webb and J A Tracy

Missouri Telemedicine Network, University of Missouri-Columbia, USA

Summary The evaluation of telemedicine activity in rural communities is complicated by the fact that most telemedicine sites are chosen because of their existing telecommunications infrastructure and institutional relationships, not by a random selection process. In addition, it is difficult to draw conclusions about the effects of telemedicine without a careful analysis of parallel changes in communities which do not have access to telemedicine services. We have developed a method of identifying comparable counties based on an aggregate measure of health status. A set of 66 variables was collected in a previous project to develop a model to evaluate the relative health status of the population in Missouri. A stepwise regression was used to identify a subset of 15 variables that had the highest predictive value for the health status of a county. Distance measures were then used to identify six counties which were most similar to three telemedicine counties. The method can be used with any study set chosen non-randomly, to identify similar objects that can be used for comparative purposes.

Introduction

The evaluation of the effect of telemedicine on the delivery of health care in communities would often be improved by randomly selecting a set of communities and implementing telemedicine in half of them. The problem with this approach is that the essence of telemedicine is communication among providers in different locations, a process dependent on institutional and other relationships predating a telemedicine trial. For telemedicine to receive a reasonable test, sites must be chosen with regard to existing relationships, a process that is hardly random.

In addition, the effective evaluation of telemedicine in rural communities requires some means of identifying alternative developments and changes that would have occurred in the absence of telemedicine. A number of factors affect the propensity for change in the delivery of health care, and it is important to understand these influences when trying to interpret changes that appear to be due to the introduction of telemedicine. Conducting comparative studies is then difficult, but not impossible. The ability to select comparison communities when the designated telemedicine sites are chosen non-randomly is the subject of this study.

Background

The Missouri Telemedicine Network is the result of a collaboration between the Missouri Rural Opportunities Council (Missouri’s state rural development council), health-care providers, telecommunication companies, the Missouri Public Service Commission, and the University of Missouri, with the object of improving the delivery of health care in rural Missouri. The Network was established in 1994 with funding from the University of Missouri Health Sciences Center,
Southwest Bell, AT&T, GTE, the US Public Health Service's Office of Rural Health Policy, and other sources, including individual sites. A grant from the National Library of Medicine permitted the connection of an additional county in the start-up phase.

The Network contains both video and digital components. The interactive video component was implemented in 22 sites in Missouri, and is used for clinical, educational and administrative purposes. Clinicians using the interactive video technology have access to electronic stethoscopes, otoscopes, document cameras and dermatological cameras. The Network's data component is used to transmit radiological images to the University of Missouri and the homes of university radiologists.

The original Network was expanded in three of the existing counties in 1996, when the National Library of Medicine contracted with the University of Missouri to implement local- and wide-area networks linking providers to each other, the University's Health Sciences Center and the Internet. The purpose of the Rural Telemedicine Evaluation Project (RTEP) was to evaluate various aspects of telemedicine services in rural communities. Evaluation studies currently under way are examining cost, physician satisfaction, cardiology outreach, nursing utilization patterns, stages of concern in adopting new technology Internet workstation utilization and emergency transfers; surveys of providers are used to measure effects on perceptions and activities.

Non-random selection

The selection of Missouri Telemedicine Network sites was non-random. Sites were chosen because of their communities' needs for improved health services and other factors thought to make them good partners in a field test of telemedicine. Because of the small number of providers in the selected communities, it was not feasible to conduct randomized studies within participating communities of groups of telemedicine and non-telemedicine providers, or their patients.

The most significant implication of this inability to assign subjects randomly is the potential generalizability of evaluation findings. It cannot be assumed that differences between subjects and some larger group (all rural providers, for example) are random, a fundamental requirement for many statistical analyses. In a situation like this, where randomization is not possible, the next best approach is to examine the extent to which the telemedicine communities and their providers are similar to other groups to which findings may be applied.

A related effect of the lack of random selection is to limit the role of significance testing. In a study involving a survey of a random sample, a test of significance would be used to estimate the likelihood that the responses of the sample (or differences between subgroups within the sample) accurately reflect the responses that would have been obtained by asking the same questions of the entire universe from which the sample was randomly drawn. Missouri Telemedicine Network providers and their patients were not randomly selected from some larger group; Missouri Telemedicine Network sites were not randomly selected from some universe of possible telemedicine sites. It is a non-sequitur to ask whether such results accurately estimate the true responses of the entire group from which the sample was randomly drawn.

Given the problems of lack of randomization and small sample size, a systematic method was devised to identify a set of matching-counties in Missouri that could be used in comparisons of the effect of telemedicine. The approach was to identify counties which were similar to the telemedicine counties in terms of a variety of factors related to the health and health-care status of the community but which did not have telemedicine structures in place.

Previously identified obstacles

Difficulties in designing and conducting studies have been documented by telemedicine evaluators and various approaches to minimize the problems have been proposed. One of the most difficult problems is the issue of random selection of treatment and control groups. A review of telemedicine literature revealed very little initial selection of study groups. Telemedicine sites are usually chosen non-randomly, due to factors mentioned already, such as existing infrastructure and communications networks. The result is the subsequent search for a way to conduct comparative studies using non-randomly selected sites.

It is possible to find studies dealing with the non-random selection of communities for studies unrelated to telemedicine. Two classic examples are the Stanford three-community and five-community studies, which began in the 1970s and continued into the 1980s. The core communities were chosen because of factors related to the ease of applying the desired treatment, which consisted of education related to lifestyle choices.

In the Stanford studies, logistics and resource requirements dictated a small sample size. The treatment communities were chosen because of the potential for conducting mass education. The control communities were chosen because of geographical, size and demographic similarities. The small sample
size and restricted choice of treatment communities is a common feature of quasi-experimental designs. Once a set of comparison communities is identified, it is possible to do an assortment of studies of the populations involved. In the Stanford example, numerous aspects of lifestyle interventions and the associated effects on health risk factors related to cardiovascular disease were studied. The initial study included two treatment components. One was a mass media campaign, while the other involved face-to-face instruction conducted on a subgroup, who were also targeted in the mass media campaign.

The Missouri Telemedicine Network sites were selected according to both technological considerations and existing community leadership networks. The process of selecting non-telemedicine comparison communities was accomplished by an analysis of health status variables available for all rural counties in the state of Missouri.

**Methods**

There are three counties involved in the RTEP. The initial process for identifying comparison counties that were as similar as possible to them was to select a series of factors that were important in relation to the health status of the population. A set of 66 variables had been collected for a previous project to develop a model to evaluate the relative health status of the population in Missouri. The variables are listed in Table 1. Five of the variables (Kidscount, Econrank, Morbidrank, Mortalrank, and Hlthrank) were aggregates.

The health rank (Hlthrank) variable was the dependent variable, and the other 65 (including the other aggregates) were tested for their value as predictors of health status. Health status was selected as the dependent variable because the goal of telemedicine is to improve health status. The Hlthrank variable enabled tracking of improvements in health status that may have resulted from the use of telemedicine.

Kidscount, another aggregate variable, was a composite of the county ranks for eight variables: students enrolled in free/reduced-fee lunch programmes; births to mothers without high school diplomas; low-birthweight infants; infant mortality; probable cause child abuse; out-of-home placement entries; annual high-school dropouts; and births to women aged 15-19. The measures came from *Kids Count*, published by the Citizens for Missouri's Children. The publication documented the status of children in all 115 of Missouri's counties.

Econrank was a measure of the economic and financial characteristics of a county. Factors correlated with health status, such as the economic climate, relative standard of living of the population and the sources of income generated within the county, were taken into consideration. Poverty, education and per capita income have also been found to be related to the health status of a population and were included in the Econrank measure.

Morbidrank provided information regarding specific morbidity indicators collected on the population in each county in the state of Missouri. Morbidity indicators consisted of communicable diseases, maternal and child health measures, and preventable hospitalizations. Morbidity may be closely related to the availability and accessibility of primary care.

Mortalrank, the final aggregate variable, provided information regarding causes of mortality. Cancer, cardiovascular problems and diabetes were included. This variable takes into account the relative contribution each cause of death made to total deaths in the county. Mortality has also been shown to be related to the availability of health services.

The model's used to create the aggregate indicator Hlthrank was the starting point for identifying comparison counties for the telemedicine evaluation project. However, it was recognized that some of the 65 independent variables would be better predictors of health status than others. In order to limit the set of variables to a more manageable group, a stepwise regression analysis was run using the Crunch program, a statistical software package that performs commonly used statistical functions.

Before running the stepwise regression, highly correlated variables were removed. Initially, predictor variables were retained in the regression analysis if they had a correlation coefficient no higher than 0.5 with each other. Among those variables demonstrating collinearity, only the variable with the highest correlation coefficient with Hlthrank was retained. For example, three variables measured the percentage of patient care needs met by physicians in a county: PGAP relates to the percentage of primary-care needs met, Tgap relates to the percentage of total physician needs met, and SGAP measures the percentage of specialty care needs met by medical/surgical specialists in the county. Since the three variables measured a similar facet of health status, only PGAP, the measure with the highest correlation coefficient of the three, was used in the ranking of non-telemedicine counties as good comparisons for the telemedicine counties.

After eliminating the 23 variables demonstrating multi-collinearity, a stepwise regression analysis of the remaining 42 was performed. Variables were only entered at $P < 0.05$. The result was a subset of 15
Table IOriginal set of variables

<table>
<thead>
<tr>
<th>Variable</th>
<th>Sources</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>POP95</td>
<td>1</td>
<td>Number of residents in county in 1995</td>
</tr>
<tr>
<td>Pop65+</td>
<td>1</td>
<td>Percentage of population aged 65 and over</td>
</tr>
<tr>
<td>POP85+</td>
<td>1</td>
<td>Percentage of population aged 85 and over</td>
</tr>
<tr>
<td>Chg90-95</td>
<td>1</td>
<td>Percentage change in population between 1990 and 1995</td>
</tr>
<tr>
<td>Admits</td>
<td>2</td>
<td>Hospital admissions by county’s resident population</td>
</tr>
<tr>
<td>Births</td>
<td>2</td>
<td>Number of live births</td>
</tr>
<tr>
<td>Caid95</td>
<td>4</td>
<td>Percentage of births paid for by Medicaid</td>
</tr>
<tr>
<td>Commute</td>
<td>3</td>
<td>Percentage of population commuting outside county of residence for work</td>
</tr>
<tr>
<td>Sales</td>
<td>3</td>
<td>Retail sales per capita</td>
</tr>
<tr>
<td>Density</td>
<td>5</td>
<td>Population density per square mile</td>
</tr>
<tr>
<td>MVdeaths</td>
<td>2</td>
<td>Number of motor vehicle deaths per 100,000 population</td>
</tr>
<tr>
<td>Runsper</td>
<td>2</td>
<td>Number of emergency vehicle runs per 100,000 population</td>
</tr>
<tr>
<td>PGAP94</td>
<td>5</td>
<td>Percentage of primary-care physician needs met in 1994</td>
</tr>
<tr>
<td>SCAP94</td>
<td>5</td>
<td>Percentage of specialty physician care needs met in 1994</td>
</tr>
<tr>
<td>TGAP94</td>
<td>5</td>
<td>Percentage of total physician care needs met in 1994</td>
</tr>
<tr>
<td>Poprate</td>
<td>2</td>
<td>Number of primary-care physicians per 10,000 population</td>
</tr>
<tr>
<td>Medrate</td>
<td>2</td>
<td>Number of medical specialty physicians per 10,000 population</td>
</tr>
<tr>
<td>Surgrate</td>
<td>2</td>
<td>Number of surgical specialty physicians per 10,000 population</td>
</tr>
<tr>
<td>Suprate</td>
<td>2</td>
<td>Number of supporting physicians per 10,000 population</td>
</tr>
<tr>
<td>Totrate</td>
<td>2</td>
<td>Total number of physicians per 10,000 population</td>
</tr>
<tr>
<td>Kidscount</td>
<td>4</td>
<td>Aggregate Kidscount score</td>
</tr>
<tr>
<td>Econranks</td>
<td>5</td>
<td>Aggregate economic index score</td>
</tr>
<tr>
<td>Hithrank</td>
<td>5</td>
<td>Aggregate health status index score</td>
</tr>
<tr>
<td>Homehith</td>
<td>3</td>
<td>Number of home health visits per 1000 population</td>
</tr>
<tr>
<td>Dentper</td>
<td>2</td>
<td>Number of dentists per 10,000 population</td>
</tr>
<tr>
<td>Hygenper</td>
<td>2</td>
<td>Number of dental hygienists per 10,000 population</td>
</tr>
<tr>
<td>LPNper</td>
<td>2</td>
<td>Number of licensed practical nurses per 10,000 population</td>
</tr>
<tr>
<td>Optomper</td>
<td>2</td>
<td>Number of optometrists per 10,000 population</td>
</tr>
<tr>
<td>Pharmper</td>
<td>2</td>
<td>Number of pharmacists per 10,000 population</td>
</tr>
<tr>
<td>OTper</td>
<td>2</td>
<td>Number of occupational therapists per 10,000 population</td>
</tr>
<tr>
<td>PTper</td>
<td>2</td>
<td>Number of physical therapists per 10,000 population</td>
</tr>
<tr>
<td>COMTTYper</td>
<td>2</td>
<td>Number of community health registered nurses per 10,000 population</td>
</tr>
<tr>
<td>ADVPRper</td>
<td>2</td>
<td>Number of advanced practice registered nurses per 10,000 population</td>
</tr>
<tr>
<td>RNper</td>
<td>2</td>
<td>Number of registered nurses per 10,000 population</td>
</tr>
<tr>
<td>TOTRNper</td>
<td>2</td>
<td>Number of total registered nurses per 10,000 population</td>
</tr>
<tr>
<td>Lunch95</td>
<td>4</td>
<td>Percentage of students participating in school lunch programmes in 1995</td>
</tr>
<tr>
<td>Bth-HS95</td>
<td>4</td>
<td>Percentage of births to mothers without a high school education in 1995</td>
</tr>
<tr>
<td>Lowwt15</td>
<td>4</td>
<td>Percentage of births to low birthweight</td>
</tr>
<tr>
<td>Infmrt5</td>
<td>4</td>
<td>Infant mortality rate</td>
</tr>
<tr>
<td>Kidmrt5</td>
<td>4</td>
<td>Mortality rate for children aged 14 and under</td>
</tr>
<tr>
<td>Abuse95</td>
<td>4</td>
<td>Rate of suspected child abuse in 1995</td>
</tr>
<tr>
<td>Drop94</td>
<td>4</td>
<td>High school dropout rate in 1994</td>
</tr>
<tr>
<td>TeenBr95</td>
<td>4</td>
<td>Percentage of births to young teenage mothers in 1995</td>
</tr>
<tr>
<td>Violnt5</td>
<td>4</td>
<td>Rate of violent deaths among teenagers</td>
</tr>
<tr>
<td>Morbdrank</td>
<td>5</td>
<td>Aggregate morbidity index score</td>
</tr>
<tr>
<td>Mortality</td>
<td>2</td>
<td>Number of deaths per 100,000 population</td>
</tr>
<tr>
<td>Mortairank</td>
<td>5</td>
<td>Aggregate mortality index score</td>
</tr>
<tr>
<td>Snfbedper</td>
<td>2</td>
<td>Skilled nursing facility beds per 1000 population aged 65 and over</td>
</tr>
<tr>
<td>Icfbedper</td>
<td>2</td>
<td>Intermediate-care nursing facility beds per 1000 population aged 65 and over</td>
</tr>
<tr>
<td>Rbedper</td>
<td>2</td>
<td>Residential care facility beds per 1000 population aged 65 and over</td>
</tr>
<tr>
<td>Prenatal</td>
<td>4</td>
<td>Percentage of births with inadequate prenatal care</td>
</tr>
<tr>
<td>Immune</td>
<td>4</td>
<td>Percentage of children fully immunized</td>
</tr>
<tr>
<td>Poverty</td>
<td>3</td>
<td>Percentage of population below poverty level</td>
</tr>
<tr>
<td>Pov18</td>
<td>3</td>
<td>Percentage of population under age 18 below poverty level</td>
</tr>
<tr>
<td>Pov65</td>
<td>3</td>
<td>Percentage of population aged 65 and over below poverty level</td>
</tr>
<tr>
<td>College</td>
<td>3</td>
<td>Percentage of population with some college education</td>
</tr>
<tr>
<td>Mtg</td>
<td>3</td>
<td>Percentage of workforce employed in manufacturing</td>
</tr>
<tr>
<td>Unemp</td>
<td>3</td>
<td>Unemployment rate in county</td>
</tr>
<tr>
<td>Incorp</td>
<td>3</td>
<td>Percentage of population living in incorporated places</td>
</tr>
<tr>
<td>AFDC95</td>
<td>4</td>
<td>Percentage of student population receiving Aid to Families with Dependent Children in 1995</td>
</tr>
<tr>
<td>Food95</td>
<td>4</td>
<td>Percentage of student population receiving food stamps in 1995</td>
</tr>
<tr>
<td>Caid95</td>
<td>4</td>
<td>Percentage of student population receiving Medicaid in 1995</td>
</tr>
<tr>
<td>Bedsper</td>
<td>2</td>
<td>Number of hospital beds per 1000 population</td>
</tr>
<tr>
<td>Intense</td>
<td>5</td>
<td>Hospital intensity score</td>
</tr>
<tr>
<td>Retain</td>
<td>5</td>
<td>Percentage of population using local hospital</td>
</tr>
<tr>
<td>PCincome</td>
<td>3</td>
<td>Per capita income</td>
</tr>
</tbody>
</table>

*Sources: 1. Missouri Office of Administration; 2. Missouri Center for Health Statistics, Center for Health Information Management and Epidemiology, Missouri Department of Health; 3. Office of Social and Economic Data Analysis, University of Missouri; 4. Kids Count in Missouri (a partnership of Citizens for Missouri's Children, the Children's Trust Fund and the University of Missouri's Office of Social and Economic Data Analysis); 5. derived.
The 15 variables over the three telemedicine counties. The reference point is a vector of the means of the 15 variables. The reference is a vector of the means of the distance to a reference point based on the 15 variables. The means, and if si denotes the standard deviation of the ith variable as found from all three telemedicine counties, then D, for the ith county is defined by:

$$D_i = \sqrt{\sum_{j=1}^{15} \left( \frac{x_{ij} - m_j}{s_j} \right)^2}$$

The second distance variable, D2, was obtained in the same way as D1, except the square root of the sum of the squares of the standardized differences in values. Let xij denote the value for the ith variable for the ith county. If mi denotes the mean value of the jth variable as determined by the three telemedicine counties, and if si denotes the standard deviation of the jth variable as found from all counties, then D2, for the ith county is defined by:

$$D_2 = \sum_{j=1}^{15} I_{A} \left[ \left| Z_{ij} \right| 1.28 \right]$$

where 1A denotes an indicator variable for the set A, and Zij denotes the distance (xij - mij)/sij in terms of standard deviation. The fewer the number of variables that exceed the 1.28 cut-off, the more similar the county is to the mean of the three telemedicine counties.

The third distance variable, D3, was calculated using principal-components analysis. Much of the total information contained in a set of variables can often be summarized by a few principal components. Given a set of variables, its first principal component is the linear combination that has the largest variance among all linear combinations. For the comparative counties problem, the value of the first two principal components was found for each county. The mean values, m1 and m2, of the two principal components for the three telemedicine counties was then found. D3 was then calculated from the square of the distance of each principal component from the mean value of the telemedicine counties’ corresponding principal component.

Since the units of measurements of the 15 variables differed, it was necessary to standardize the measurements, and this was accomplished by dividing by a standard deviation. Since the difference might be positive or negative, adding the values might cancel them out to make a county seem similar to the three telemedicine counties when in fact it was not. A more standard distance measure was obtained by calculating the square root of the sum of the squares of the standardized differences in values. Let xij denote the value for the ith variable for the ith county. If mi denotes the mean value of the jth variable as determined by the three telemedicine counties, and if si denotes the standard deviation of the jth variable as found from all counties, then D, for the ith county is defined by:

$$D_i = \sqrt{\sum_{j=1}^{15} \left( \frac{x_{ij} - m_j}{s_j} \right)^2}$$

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### Table 2 Final variables used in selecting comparable counties

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Health climate</td>
<td>Percentage of population aged 65 and over</td>
</tr>
<tr>
<td>Pop65+</td>
<td>Percentage of births with inadequate prenatal care</td>
</tr>
<tr>
<td>Prenatal</td>
<td>Aggregate morbidity index score</td>
</tr>
<tr>
<td>Morbidrank</td>
<td>Aggregate mortality index score</td>
</tr>
<tr>
<td>Mortalrank</td>
<td>Aggregate Kidscount score</td>
</tr>
<tr>
<td>Kidscount</td>
<td>Population density per square mile</td>
</tr>
<tr>
<td>Resources</td>
<td>Percentage of primary-care physician needs met in 1994</td>
</tr>
<tr>
<td>PGAP94</td>
<td>Hospital intensity score</td>
</tr>
<tr>
<td>Intense</td>
<td>Number of home health visits per 1000 population</td>
</tr>
<tr>
<td>PCIncome</td>
<td>Per capita income</td>
</tr>
<tr>
<td>Econrank</td>
<td>Aggregate economic index score</td>
</tr>
<tr>
<td>Utilization</td>
<td>Hospital admissions by county’s resident population</td>
</tr>
<tr>
<td>Admits</td>
<td>Number of home health visits per 1000 population</td>
</tr>
<tr>
<td>Homehith</td>
<td>Percentage of population below poverty level</td>
</tr>
<tr>
<td>Pop65+</td>
<td>Skilled nursing facility beds per 1000 population aged 65 and over</td>
</tr>
<tr>
<td>Poverty</td>
<td>Percentage of population using local hospital care</td>
</tr>
<tr>
<td>Retain</td>
<td>Percentage of births with inadequate prenatal care</td>
</tr>
<tr>
<td>Switbedper</td>
<td>Percentage of births with inadequate prenatal care</td>
</tr>
</tbody>
</table>

The next step was to identify counties that were most similar to the telemedicine counties in terms of social, economic and medical characteristics. The similarity is referred to here as ‘distance’, or the degree to which counties shared characteristics with the telemedicine counties. The measure of distance is not meant to indicate geographical proximity, but rather mathematical distance. Mathematically, the distance between points in n-dimensional space is often measured geometrically by taking the square root of the sum of the squares of the differences in coordinates. Coordinates, here, refer to the identified characteristics of the counties.

In order to measure the distance, or similarity, a statistical analysis was employed using SAS software. Three variables were defined, and will be referred to here as distance 1 (D1), distance 2 (D2), and distance 3 (D3). The variables made use of the 15 factors identified in Table 2 and were used to rank the counties.

The first variable, D1, was determined by finding the distance to a reference point based on the 15 variables. The reference point is a vector of the means of the 15 variables over the three telemedicine counties.
Slightly, different ways, but in each case, smaller counties. The three measures chosen calculate distance in a similar way, of the counties compared with the telemedicine value for county \( p \). The distance \( D_3 \) for the \( i \)th county is given by:

\[
D_3 = (p_{11} - mp_1)^2 + (p_{12} - mp_2)^2
\]

where \( p_{11} \) denotes the value of the first principal-component value for county \( i \), and \( p_{ij} \) is similarly defined.

Clearly, there are other measures of distance or similarity, of the counties compared with the telemedicine counties. The three measures chosen calculate distance in slightly, different ways, but in each case, smaller counties were most similar to them (Table 3). This indicated that the three telemedicine sites were relatively close in characteristics. The six non-telemedicine counties were then selected as the comparison counties.

### Discussion

The process of evaluating the effect of telemedicine on the delivery of health services in rural communities requires valid comparisons between telemedicine and non-telemedicine sites. When statistical methods that numbers mean less distance from, or more similarity to, the mean values of variables relating to the three telemedicine counties.

### Results

Any one of the three distance measures could be used to find counties which were similar to the telemedicine counties. In this study, the information was combined from all three. Missouri counties were ranked in terms of each of the three variables (\( D_1 \), \( D_2 \), and \( D_3 \)), and the ranks were summed to arrive at a total score. The lowest nine scores included the three telemedicine counties and the six non-telemedicine counties that were most similar to them (Table 3). This indicated that the three telemedicine sites were relatively close in characteristics. The six non-telemedicine counties were then selected as the comparison counties.

### Table 3 Variables and values for telemedicine and comparison counties

<table>
<thead>
<tr>
<th>Variables</th>
<th>Telemedicine counties</th>
<th>Comparison counties</th>
</tr>
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<tr>
<td></td>
<td>( T_1 )</td>
<td>( T_2 )</td>
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<tr>
<td>( D_1 )</td>
<td>2.29</td>
<td>2.34</td>
</tr>
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<td>1</td>
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<td>( D_3 )</td>
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<td>12</td>
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<tr>
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</tr>
<tr>
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<td>Mortdrlank</td>
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<td>Econrank</td>
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<td>Stbedper</td>
<td>61.7</td>
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</table>
require randomization are inapplicable, systematic matching is a good alternative. Before-and-after comparisons may be difficult because of a slow start-up phase, during which the volume of telemedicine events can be low and continuing technological developments may jeopardize the study results. Pooling of data-sets has been suggested, but pooled data based on non-random selection are no more random than they were before being combined. The approach used in this study could be used in any community study in which random selection is unavailable.

This article provides an illustration and description of an appropriate methodology for selection of comparable communities. In the present study, health status and various independent variables affecting health status were used. The method is sufficiently general to use any set of variables appropriate to the nature of the study under consideration.

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BARRIERS TO THE INITIAL ACCEPTANCE OF TELEMEDICINE TECHNOLOGIES IN A RURAL SETTING

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Introduction

Technology is a key governing force in society. Some may even argue that technological change drives social change (Smith, 1996). Thus the importance of technological change has captured the interest of many researchers who endeavor to understand the diffusion of technological progress (Rogers, 1995).

The University of Missouri-Columbia’s Telemedicine Demonstration Project was developed in December of 1995 to address rural health care provider needs such as isolation, lack of communication, rapid access to updated medical information, contact with colleagues, and continuing medical education opportunities. The Missouri Telemedicine Network (MTN) includes two components: video conferencing and computer infrastructure. Funding for the project came, in part, from the Rural Telemedicine Grant Program and the National Library of Medicine with the stipulation that the University would provide a thorough evaluation. The evaluation portion of the Telemedicine program is referred to as the Rural Telemedicine Evaluation Project (RTEP).

There are many issues surrounding the acceptance, or diffusion of a new technology in a rural community health setting (Rogers, 1995). The rapid pace of technology is slowed only by its acceptance (Granade and Sanders, 1997), and while the technology itself is impressive, it is ultimately the human engineering and infrastructure that will determine the effectiveness of telemedicine (Yellowlees, 1997). The purpose of this research was to explore factors that were perceived barriers to the initial acceptance of telemedicine by rural health care providers.

Method

Data were gathered from ten general practice clinics located in four communities with populations ranging from 3-8,000. Four of the practice clinics were affiliated with the University and six
of the clinics were private practice clinics. These four communities were located in three rural counties that have total populations ranging from 13,853 to 15,322.

The televideo component of telemedicine was installed in the hospitals located in the three counties and one large group practice clinic. All the physicians had the opportunity to participate, which would give them access to the video-conferencing system. The computer component of telemedicine was installed in the ten general practice clinics located in the four communities. Four of the practice clinics were private practices and six of the clinics were affiliated with either public or private tertiary care centers.

As part of the computer infrastructure, an Internet-based workstation was developed, the RTEP workstation. This workstation provided e-mail, access to the World Wide Web (WWW), medical databases such as Medline, community specific information, a calendar, and access to a medical librarian. The RTEP workstation was a user-configurable Internet Portal site, restricted by password access to participants in the Telemedicine project.

This study gathered qualitative data from semi-structured interviews. The structure of the interviews was developed from initial pilot interviews with information specialists and current MTN participants to identify suitable questions that would be useful in evaluating the adoption of telemedicine technology.

A sampling matrix was developed that included a list of physicians, nurses, and administrative staff from each of the ten practice clinics. All of the physicians and at least two nurses and administrative staff from each clinic were selected to be interviewed. The interviews were conducted in the offices of each clinic. Data collection occurred between March 1998 and July 1998.
After consenting to participate, participants were asked open-ended questions regarding both the video and computer components of telemedicine. Each participant was asked the following questions: What do you perceive are the advantages and disadvantages of the telemedicine technology?; What do you perceive are the barriers and facilitators to using the telemedicine technology?; How do you utilize the telemedicine technology?; Can you describe the ways in which the telemedicine technology has changed your role?; How has the telemedicine technology affected the quality of care you deliver?; and Do you have any suggestions for improving the telemedicine technology?

Demographic information was collected at the end of the interview.

The interviews were transcribed and entered into a computer textual database program, Ethnograph (Sidel, et al., 1995). The text of the Interviews was divided by the type of technology being discussed (i.e., video-conferencing or the computer component) and a template analysis was used to organize and segment the data in order to identify major categories and common issues across the categories (Crabtree & Miller, 1992). An analysis template was first defined based on our understanding of the issues. These initial groupings or codes were then revised based on reading and sorting the text of the interviews. Multiple readings and codes of the transcribed interviews plus independent reviews by a panel of information specialists and health providers resulted in the identification of salient themes and issues.(Miles & Huberman, 1993).

Results

A total of 57 interviews were completed. This included 13 physicians, 9 of whom were male and 4 were female with an average age of 52 years and an average length of practice of nineteen years. Twenty of the interviews were with nurses or nurse practitioners, 17 of whom were female and 3 male,
with an average age of 43 years. Twenty-four interviews were with the administrative staff, 18 of whom were female and 6 male, with an average age of 45 years.

Several themes or concepts related to the acceptance of telemedicine emerged from the data: practice integration, time to employ, pace of change, apprehension of technology, accommodation to change, autonomous relations, and ownership of the technology. Each of these themes apply to the computer and televideo components of telemedicine and each may operate as a perceived barrier or facilitator of change.

**Practice Integration:** This theme addresses the issue of technological “fit” within the organization. According to Grecco & Eisenberg (1993), physicians must first recognize that their current practices need improvement. The decision to adopt or utilize a new technology rests on the perception that there is a need to “upgrade”, enhance, streamline, or improve their practice and that the technology will enable them to deliver patient care. For some of the physicians in primary care whom we interviewed there was no compelling reason to adopt computerized information technology into their practice.

One physician in private practice who rarely used the computer said:

“It doesn’t really help a lot. I think computers are good for specialists and in primary care you know basically most of the stuff - 80 to 95% of the stuff you know by now anyway - because you see it all the time. Then the other 20, 15, 20% of it that’s more difficult - you look it up in routine journals. And if it’s not there, if it’s not very clear and if it’s a serious problem, why that’s when I think you should send people to the specialist, because that’s what they’re there for. You know, I mean, take the things that we do - most specialists couldn’t do what we do, it’s too broad. But then again, we can’t do what they do, you know, I mean you kind of fit together - it works alright but if you try to work separately it doesn’t work so good.”

“Well first, it’s a new thing and it hasn’t been - we haven’t used it in our practice and it’s hard for us to get out of our old habits of how we do things. And so I think that’s to me a major
thing. I’m talking to the other doctors - they don’t think of it and then I mentioned it and they said - oh, it sounds like that would be alright.”

Similarly, when asked about using the video conferencing, one nurse said:

“The doctors, getting them, our doctors here, just familiar enough to want to use it. That’s been a big problem for us. We’ve shown it to them, we’ve had programs on it. They still don’t think of it.”

While some physicians did not see the need for telemedicine or forgot to use it, others welcomed it and readily saw the potential capabilities that would enhance their practice. In most instances, these physicians had an established affiliation with a tertiary care center where computer technology played a prominent role in the delivery of patient care. One primary care physician affiliated with a large tertiary center said:

“...the computer - just get us hooked up to the University. What I’d like to do with the University - I’d like to be able to find out people - like I’m not real familiar with a lot of doctors down there-the doctors change a lot - the names and the departments...I need to know how to find e-mails on some of the doctors who I’m going to use them. What I need is to be able to get stuff out...because Medical records down there is slow. I need to be able to get into the medical record. I don’t know what they’re going to do with confidentiality stuff, but I need to be able to pull a chart up. I need to be able to pull records and stuff like that. If someone’s been at the University - progress notes, whatever lab test - that kind of stuff. I need to be able to go to the computer and pull it out. That’s what I need.”

Regarding the video conferencing, one physician also affiliated with a tertiary center decried the lack of use of the equipment by some of the physicians associated with the local hospital said:

“Hell, if the other guys (in the rural hospital) aren’t going to use it, just bring it down here and let me use it. I could probably utilize it a heck of a lot better than they could. If they’re not
willing to...cause I’ve told them over and over, ‘See it’s really nice. It’s a convenience for the patient.’”

**Time to Employ:** In a busy rural primary care practice, time is a scarce commodity. In this context, the theme of time refers to a finite resource in which the participants have to learn and utilize the technology. Unfortunately, computerized information technology has an initial learning curve that requires considerable time and effort. Efficiency is an important aspect of this theme. As one nurse/office manager said about the computer:

“It takes time to learn to use it and to do it. And you spend a lot of time doing it. And where if I’m looking up something in a book, maybe the book is old, but at least I could have it done in five minutes. And now, until I get good at this, you know, it’s taking me much longer.”

The video conferencing component of telemedicine was also seen by some participants as an intrusion on their time. As one physician said:

“Well, this is kind of like a rural community, you know, and sometimes it takes a lot of time to pursue it with the patient. They will get the same type of care if they would see the physician personally. So, actually it takes lots of our time sometimes, you know, of our appointments just to pursue them to come for a telemedicine appointment.”

While some participants saw telemedicine as an intrusion on their time, others recognized the potential time-saving features of telemedicine. An administrator who identified the potential benefits of the computer said:

“Everybody’s pretty interested in it...I think everybody’s kind of getting in to it because then you’re going to be able to correspond a lot without having to send memos and stuff and you can do it through the computer and save a lot of paper and time.”
Correspondingly, a physician noting the advantages of video conferencing said:

“Time advantages, convenience advantages so people won’t have to travel...That’s always very much appreciated by the people that we refer. They say, “Oh, you mean we can see a specialist without having to go to (the tertiary center)? I have a lot of older patients that appreciate not having to travel that distance. I think those are all the added benefits of it”.

Pace of Change: Several of the participants in the project mentioned the slower rate of change that occurs in rural communities. Technological change moves at a slower pace than in urban communities.

One nurse practitioner in the study said:

“I think that in general the community is pretty much behind the nation as an average, using technology. We got 911 three years ago. Three years before that, we finally had a seven-digit phone number. So, I think it’s very possible to make the change, but I think that the expectations for the rate of change and the learning curve should be pretty generous.”

Not only did the participants acknowledge the slower pace of technological change that occurs in rural settings, but they acknowledged the slower pace of gaining acceptance in a rural culture as well.

A primary care physician alluded to this when he said:

“Background is extremely important to what’s accepted. And although you move into the community and you can be here 20 years, you’re an outsider. And if you are not sensitive to that, you can make some really big errors not knowing it.”

Although some participants noted the slower pace of change in a rural community, several participants were positive that telemedicine would eventually catch on. When discussing the impact of telemedicine, one administrator said:
“I think we’re starting to see that we’ll have a network of computers where we can talk to nursing homes locally, talking with physicians offices, and transporting data back and forth as far as lab tests and patient information..I think that’s going to expand faster, probably faster that the actual (video) portion for us.”

Apprehension of Technology: For many of the participants in our study the implementation of telemedicine led to some anxiety about using the new technology. As one nurse practitioner said:

“I guess the number one (barrier) would just be anything that’s new or different often seems to cause some hesitation or almost an automatic dislike in many folks.”

“People are scared of technology” said one physician. “Computer phobia,” for example, is something that has to be overcome. In response to the question on barriers to using the RTEP workstation, one nurse said:

“Mostly just the lack of knowledge of how to run a computer. Mine at home is just basic. I don’t have any of this fancy stuff. But, I don’t get on it too much. I’m always afraid I’ll push the wrong button and delete something, and get into something I’m not even hooked up to and all of a sudden something will come up and it will say illegal action. It scare me. I think ‘Oh my gosh I’ve done something against the law,’ you know. I think that would be the worse, people not understanding it and what to use if for. This is hard.”

Likewise, some of the participants were apprehensive of using the video conferencing technology. One physician said:

“A lot of it is just still overcoming some of the initial hesitation to use it on both the consultant’s and the referring doctor’s part, convincing each party that you can get good information and data from such interchanges and that it’s not as complex as it seems at first.”
Along with the anxiety that telemedicine technology may bring to the rural practice, there was a concern about the validity of the information that was being provided over the Internet. A physician who was reluctant to use the RTEP workstation said:

“The biggest thing I have with it (the Internet) is you don’t know [what] you’re getting – who’s writing the articles, you know, and I, I prefer software through Scientific American that I use and know those people are supposedly respectable researchers. You know what you get is good. You just pull it off the Internet and you have no idea where it’s coming from and there’s a lot of stuff on the Internet that’s no good.”

In addition, while some physicians remained apprehensive towards utilizing telemedicine, they were willing to let others in their practice learn and use the new technology. A physician in private practice said:

“I think I’m going to leave that up to my people. The only interest that I have is, uh, just to get some medical literature when I need some topic, that’s the only thing. But one of my people, she is into that, you know, in the computers. I’m sure she’s going to be wanting to learn it.”

**Accommodation to Change:** This theme refers to the ability to adjust to technological change. The introduction of a new technology often requires individuals to accommodate to disruptions in habitual ways of doing things (Arthur, 1996, Treister, 1998). With respect to the change in practice behaviors that telemedicine may bring, several of the participants were reluctant to alter their practice. A physician in private practice said:

“We don’t wanna change. Everybody’s just fine the way it is...I’m not prepared for this.”

Similarly, another physician in private practice said:
“...as a group we have a tendency to be pretty stuck in our ways and have a pretty firm resistance to change.”

One physician in private practice who recognized the possible need to change but remained inflexible said:

“Much like me with the computer. I don’t want to take the time to learn and the way I’ve always done it is the best way and you know that’s pretty antiquated. I know I do it.”

While some may be reluctant to change, others remain skeptical in their approach toward adopting any new technology but are willing to consider its potential. One primary care physician reflected on the changes he has undergone since graduating from medical school:

“I can remember reading, you know, histories of medicine and stuff like that when I was a pre-med student and thinking to myself now, you know, ‘Gee, this is awful. And I’ll never be that way. When I get to be a doctor, I’ll be different.’ And I have to remind myself of that almost on a daily basis. You don’t want to jump in with both feet on every new thing that come along, because some of it turns out to be no good, you know. And if you buy all that stuff, you can go broke easily. But when something, you know, really looks like it’s becoming mainstream, then you can get on the bandwagon or else the parade’s going to leave you behind.”

Some participants, however, did see the need change. One physician who disliked computers, yet saw the need to learn it said:

“Well, I really don’t like it because it’s not my type of thing, but I’m going to have to learn it”

**Autonomous Relations:** This theme refers to the degree to which participants perceived telemedicine was an intrusion on their territory by a tertiary care center (Carlson, 1998). While some participants saw the technology as a, “good thing... it was nice to be connected to a big University,” others saw it as
a potential threat to their sense of competency, autonomy or livelihood (Grecco & Eisenberg, 1993). One office staff participant said:

“Some of the disadvantages have been, that I’ve seen, are the perception that possibly they’re, the work professionals, are not seen as practicing their craft correctly. That they’re not up to speed and that’s why this has come out here.

When change such as telemedicine is introduced into a rural setting from outside the community there may be a perceived potential threat to autonomy. A nurse practitioner alluded to this when she said:

“We are rural. We are mostly average to below-average income. And I think the way somebody comes from a university with a new idea to fix or to help, depending on one’s perception, can make a big difference in how something new is perceived and received. So I have experienced times when, although the intentions were good, the community has rejected it hands-down because they didn’t need help from the outside.”

In a similar context, the introduction of telemedicine may be perceived as a potential threat to one’s livelihood. One staff member commenting on the problem of reimbursement for the video conferencing component of telemedicine said:

“So then I question why aren’t the doctors using it? Is it a money issue?...Well, how do we get paid for it. And we didn't actually see the patient, they [the university] did. But yet we want to be reimbursed for our time that was spent. And I think that that’s one of the issues that’s still being discussed and figuring out how to solve that issue, because you do have, you know, you’re going to have an LPN or an RN that’s running this equipment so you have that expense of that person and so how do you justify that expense when you’re really not being reimbursed for it or they don’t see how they can be reimbursed.”
Ownership of the Technology: This theme refers to the degree to which participants are invested in the technology to the point that they become stakeholders. Although some participants expressed no desire to invest in telemedicine, there were some participants who not only acknowledged its potential benefits but adapted the technology to their special needs. As might be expected, this investment in the technology was usually done by those in administrative positions. One administrator who helped develop their own policies for using telemedicine said:

“Yeah, we’ve, our group here in...on the network side developed our own policies. We took some of the modules and modified them to match what we thought. And we really had good success, we had everybody buy into using the same policies, so we didn’t have a problem there.”

Those who have an investment in the new technology also what to encourage others to use it. This was evident when an administrator who encouraged the more use of the computer said:

“I don’t worry about the members of this group using it in a negative way. I want them to utilize it more, even if they’re getting on an using it for recreational activities. The more exposure that they have to it, the more accustomed they’re going to be to using it and I don’t think that they waste their time, I encourage them to get on there and look around to see what they can find. Especially as it relates to their job.”

Discussion

Qualitative inquiry is a very useful method to discover phenomena that aids in the interpretation of meanings that participants ascribe to change (Greenhalgh and Taylor, 1997). However, as with any research method issues arose in our study that had the potential to limit the validity of the results. For example, one issue that arose throughout the interview process was that some interviewees may have provided us with answers that were socially desirable. While this bias in responses certainly can exist,
the openness with which participants discussed their perceptions of the introduction of telemedicine and the guarantee of anonymity appeared to minimize this bias. Other potential limitations include the reluctance on some providers part to grant an interview, problems with scheduling an interview, and the interviewee not following through with the interview, especially physicians who were often detained by patient care. Despite these latter limitations, sufficient information was gathered to allow for data analysis.

The results of this study show that participants can vary widely in their receptivity towards the introduction of telemedicine. The seven themes that emerged from our data provide a framework for understanding some of the barriers to introducing telemedicine into a rural health care setting. While each of the themes have been noted to a varying degree in the literature (Grecco & Esenberg, 1993; Yellowless, 1997, Mazmanian, Banks, Self, and Hampton, 1996, Menduno, 1998, Treister, 1998, Appleby, 1997, Keoun, 1996, Chi-Lum, Lundberg, and Silberg, 1996, Bergman, 1995, Arthur, 1996), taken together, these themes represent important contextual elements of the rural health environment.

While recognizing that technical issues such as user-friendliness of the technology can also be perceived as a barrier towards implementing telemedicine, the elemental themes that emerged from our data help us to look at the broader structural and attitudinal conditions of the environment into which telemedicine is being introduced.

In many ways the introduction of telemedicine into a rural health care setting is analogous to what happens when managed care is introduced into rural areas. According to Gibbons (1998), while some rural health providers perceive managed care as an opportunity to enhance community development through reshaping and revitalization of the rural delivery system, others see it as a system that will gobble up the rural systems and patients, taking the local health care dollar away. Similarly,
telemedicine may be perceived as an opportunity to enhance the delivery of health care or it may be perceived as not essential at best or, at worse, perceived as a threat. Clearly, the initiation of telemedicine in a rural practice does not occur in a vacuum and knowledge of the environmental conditions, both structural and attitudinal, surrounding the practice plays a vital role in determining the potential for success in adopting telemedicine.

In this context, the seven themes identified in our study provide some of the essential ingredients for understanding the process of technological change in a rural health care practice. Viewed as a continuum, acceptance of telemedicine is more likely to occur when there is a greater organizational integration of the new technology, a perceived increase in time efficiency, greater affiliation with a tertiary care center, a perceived increase in ownership, an enhanced ability to accommodate the changes, a reduction in apprehension, and the realization of the pace of change in a rural community. Likewise, telemedicine is less likely to occur when there is a lack of organizational integration, a perceived decrease in time efficiency, no affiliation with a tertiary care center, a perceived lack of ownership, an inability to accommodate change, an increase in apprehension, and a lack of understanding the pace of change in a rural community.

Following the work of Donabedian (1985), the themes identified in our study can be adapted to an explanatory model that clarifies their relationships. As Figure 1 shows, the degree of telemedicine utilization (outcome) is dependent on the characteristics of the rural health care practice (structure) and the organizational reconciliation to the introduction of telemedicine (process) that occurs within the rural setting (context).
Perhaps the single most important lesson to be learned is that implementation strategies need to be tailored to the environmental conditions of the targeted health care agency. It is apparent from our study that the selection of the targeted health care agency is critical to the potential growth of telemedicine. Clearly, focusing on those environmental contexts of the health care agencies that are most receptive to telemedicine allows for a greater potential for the benefits of telemedicine to be realized.

Establishing relationships with a targeted health care agency begins with the process of negotiation, which involves a diplomacy that allows for a sensitivity to unique local conditions. A commitment must be made to nurture the relationship in order to allow for sustainability. Although the true impact of telemedicine has yet to be realized, the potential is there for a positive impact on rural health care. Future research should focus on the development of strategies for change that integrate the constituent elements of the environment that include the seven themes which we have presented in order to overcome some of the barriers to the acceptance of telemedicine.
References

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Figure 1: Explanatory Model Illustrating the Relationships Among the Seven Themes

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<th>PRACTICE STRUCTURE</th>
<th>ORGANIZATIONAL PROCESS</th>
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<td>Utilization</td>
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! Direction of Technological Change
THE INTRODUCTION OF TELEMEDICINE TECHNOLOGIES IN A RURAL SETTING: THE CLIMATE OF CHANGE

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Objective: The purpose of this study was to research what factors affected health providers’ receptivity towards the introduction of telemedicine in a rural setting.

Setting: Ten health care practices located in four communities within three rural Missouri counties.

Participants: Physicians, nurses, and administrative personnel.

Design: Qualitative study with detailed interviews.

Results: Participants varied widely in their perceptions of telemedicine. Seven core themes associated with health care provider’s receptivity to technological change emerged from the data. These themes were practice integration, time to employ, pace of change, apprehension of technology, accommodation to change, autonomous relations, and ownership of the technology. Each of these themes apply to the computer and televideo components of telemedicine and each may operate as a perceived barrier or facilitator of change. To provide a framework for assessing provider receptivity, each theme is presented as a barrier as noted by participants in the study.

Conclusion: The results of this study show that the culture and climate of the rural health environment including structural and attitudinal conditions is very important and must be considered when implementing new information technologies. The themes described above must be incorporated into the strategies for change in order for there to be a successful implementation of telemedicine.

Keywords: telemedicine, computers, rural health care

Introduction

Rural health care providers encounter unique challenges in delivering care to their patients. Isolation, lack of communication, lack of access to updated medical information, and lack of continuing medical education opportunities have been identified as factors that affect the delivery of health care.1-5 The introduction of telemedicine offers a promise to address these problems through the use of
computer and televideo technology. However, rural physicians and local health care communities have been slow in their acceptance of this new information technology.\textsuperscript{6-13} The purpose of this study was to research what factors affected health providers’ receptivity towards the initial introduction of telemedicine in a rural setting.

**Background**

The Missouri Telemedicine Network (MTN) began in 1995 as a demonstration project to address rural health care provider needs. It includes two components: a high-speed computer data infrastructure and two-way interactive televideo links. Funding for the project came, in part, from the Rural Telemedicine Grant Program and the National Library of Medicine with the stipulation that the University of Missouri-Columbia provide evaluation studies. These studies were referred to as the Rural Telemedicine Evaluation Project (RTEP).

The Missouri Telemedicine Network (MTN) consists of twenty-one telemedicine sites throughout sixteen counties in Missouri. Four communities with populations ranging from 3-8,000 in three rural counties were chosen for evaluation. Participation was voluntary.

The televideo component of telemedicine was installed in the hospitals located in the three counties and one large group practice clinic. All the physicians had access to the video-conferencing system. The computer component of telemedicine was installed in ten general practice clinics located in the four communities. Four of the practice clinics were private practices and six of the clinics were affiliated with either public or private tertiary care centers.

As part of the computer infrastructure, an Internet-based workstation was developed, the Rural Telemedicine Evaluation Project (RTEP) workstation. This workstation provided e-mail, access to the World Wide Web (WWW), medical databases such as Medline, community specific information, a
calendar, and access to a medical librarian. One of the main goals of the Rural Telemedicine Evaluation Project (RTEP) workstation was to provide networking and educational opportunities, and access to updated medical information.

Many successful innovations require a lengthy period of inception before the innovation can be considered to be accepted and to have made a desirable impact. This study investigated this period of inception and how rural health providers initially received telemedicine technology.

**Method**

This study gathered qualitative data from semi-structured interviews. The structure of the interviews was developed from initial pilot interviews with information specialists and current Missouri Telemedicine Network (MTN) participants. A sampling matrix was developed that included a list of physicians, nurses, and administrative staff from each practice site. All of the physicians and at least two nurses and administrative staff members from each clinic were selected to be interviewed. Data collection occurred between March, 1998 and July, 1998.

After consenting, participants were asked open-ended questions regarding both the televideo and computer components of telemedicine. Demographic information (i.e., age, gender, status, and year of terminal degree) was collected at the end of the interview.
Data Analysis

The interviews were transcribed and entered into a computer textual database program, Ethnograph. The transcripts were read several times to identify major categories and common themes, which led to the development of a coding frame. After developing the coding frame, the transcripts were reread to further develop the categories, which were then conceptualized into broader themes.

Results

A total of 57 interviews were completed. This included all 13 physicians (9 males, 4 females) with an average age of 52 years and an average length of practice of nineteen years. Twenty of the interviews were with nurses or nurse practitioners (17 female, 3 male) with an average age of 43 years. Twenty-four interviews were with the administrative staff (18 female, 6 male) with an average age of 45 years.

Several themes related to provider receptivity towards telemedicine emerged from the data: practice integration, autonomous relations, apprehension of technology, accommodation to change, time to employ, pace of change, and ownership of the technology. Each of these themes apply to the computer and televideo components of telemedicine and each may operate as a perceived barrier or
facilitator of change. We will present how each theme was perceived as a barrier to receptivity of telemedicine by participants in our study.

**Practice Integration**

This theme addresses the issue of technological fit within the practice. According to Grecco & Eisenberg, physicians must first recognize that their current practice needs improvement. The decision to adopt or utilize a new technology rests on the perception that there is a need to enhance, streamline, or improve their practice and that the technology will enable them to deliver better patient care. For some of the physicians whom we interviewed there was no compelling reason to integrate telemedicine technology into their practice. One physician in private practice who rarely used the computer said:

'It doesn’t really help a lot. I think computers are good for specialists and in primary care you know basically most of the stuff - 80 to 95% of the stuff you know by now anyway - because you see it all the time. Then the other 20% of it that’s more difficult - you look it up in routine journals. And if it’s not there, if it’s not very clear and if it’s a serious problem, why that’s when I think you should send people to the specialist, because that’s what they’re there for.

While some physicians did not see a reason to change and integrate the new technology into their practice, others simply did not think of using it. They did not necessarily reject the technology. It was, as yet, not well integrated into their practice behaviors. Regarding the video conferencing component of telemedicine, one physician in private practice said:

‘Well first, it’s a new thing and we haven’t used it in our practice and it’s hard for us to get out of our old habits of how we do things. And so I think that’s to me a major thing. I’m talking to the other doctors - they don’t think of it and then I mentioned it
and they said - oh, it sounds like that would be alright.’

Similarly, when asked about using the video conferencing, one nurse said:

‘The doctors, getting them, our doctors here, just familiar enough to want to use it. That’s been a big problem for us. We’ve shown it to them, we’ve had programs on it. They still don’t think of it.’

**Autonomous Relations**

This theme refers to the degree to which participants perceived telemedicine was an intrusion on their territory by a tertiary care center. While some participants saw the technology as a, ‘good thing... it was nice to be connected to a big University,’ others saw it as a potential threat to their sense of competency and autonomy. One office staff participant said:

‘Some of the disadvantages have been, that I’ve seen, are the perception that possibly they, the work professionals, are not seen as practicing their craft correctly. That they’re not up to speed and that’s why this has come out here.

A nurse practitioner who saw the introduction of telemedicine coming from outside the rural community as a perceived potential threat to autonomy said:

‘We are rural. We are mostly average to below-average income. And I think the way somebody comes from a university with a new idea to fix or to help, depending on one’s perception, can make a big difference in how something new is perceived and received. So I have experienced times when, although the intentions were good, the community has rejected it hands-down because they didn’t need help from the outside.’

**Apprehension of Technology**
For many of the participants in our study the implementation of telemedicine led to some anxiety about using the new technology. *People are scared of technology* said one physician. In response to the question on barriers to using the Rural Telemedicine Evaluation Project (RTEP) workstation, one nurse said:

*I’m always afraid I’ll push the wrong button and delete something, and get into something I’m not even hooked up to and all of a sudden something will come up and it will say ‘illegal action.’ It scares me. I think ‘Oh my gosh I’ve done something against the law,’ you know. I think that would be the worse, people not understanding it and what to use if for. This is hard.*

Likewise, some of the participants were apprehensive of using the video conferencing technology. One physician said:

*‘A lot of it is just still overcoming some of the initial hesitation to use it on both the consultant’s and the referring doctor’s part, convincing each party that you can get good information and data from such interchanges and that it’s not as complex as it seems at first.’*

In addition, while some physicians remained apprehensive towards utilizing telemedicine, they were willing to let others in their practice learn and use the new technology. A physician in private practice said:

*I think I’m going to leave that up to my people. The only interest that I have is just to get some medical literature when I need some topic, that’s the only thing. But one of my people, she is into computers. I’m sure she’s going to be wanting to learn it.*

**Accommodation to Change**
This theme refers to the ability to adjust to technological change. The introduction of a new technology often requires individuals to accommodate to disruptions in habitual ways of doing things. With respect to the change in practice behaviors that telemedicine may bring, several of the participants were reluctant to alter their practice. A physician in private practice said:

*We don’t wanna change. Everybody’s just fine the way it is...I’m not prepared for this.* Similarly, another physician in private practice said: ‘...as a group we have a tendency to be pretty stuck in our ways and have a pretty firm resistance to change.’

One physician in private practice who recognized the possible need to change but remained inflexible said:

‘Much like me with the computer. I don’t want to take the time to learn and the way I’ve always done it (is) the best way and you know that’s pretty antiquated. I know I do it.’

While some may be inflexible, others remain skeptical. One primary care physician reflecting on the changes he has undergone since graduating from medical school said:

‘I can remember reading, you know, histories of medicine and stuff like that when I was a pre-med student and thinking to myself now, ‘Gee, this is awful. And I’ll never be that way. When I get to be a doctor, I’ll be different.’ And I have to remind myself of that almost on a daily basis. You don’t want to jump in with both feet on every new thing that come along, because some of it turns out to be no good.’

**Time to Employ**

In a busy rural primary care practice, time is a scarce commodity. In this context, the theme of
time refers to a finite resource. Participants have limited time to learn and utilize the technology.

Efficiency is an important aspect of this theme. As one nurse/office manager said:

'It takes time to learn to use it and to do it...and where if I’m looking up something in a book, maybe the book is old, but at least I could have it done in five minutes...until I get good at this it’s taking me much longer.'

One physician who saw learning the computer as a totally impractical said:

'It’s basically the time factor for me. It’s gonna be off-time - my free time. And my free time hasn’t been more in recent times and I just literally, just literally haven’t had the time to start. I think it’s something I want to do and it’s basically the free time factor in terms of learning the process.'

Pace of change

Several of the participants in the project mentioned the slower rate of change that occurs in rural communities. Technological change moves at a slower pace than in urban communities. One nurse practitioner in the study said:

'I think that in general the community is pretty much behind the nation, on average, using technology. We got 911 three years ago. Three years before that, we finally had a seven-digit phone number. So, I think it’s very possible to make the change, but I think that the expectations for the rate of change and the learning curve should be pretty generous.'

Not only did the participants acknowledge the slower pace of technological change that occurs in rural settings, but also the slower pace of gaining acceptance in a rural culture as well. A physician alluded to this when he said:
'Background is extremely important to what’s accepted. And although you move into the community and you can be here 20 years, you’re an outsider. And if you are not sensitive to that, you can make some really big errors not knowing it.'

Ownership of the Technology

This theme refers to the degree to which participants are invested in the technology to the point that they become stakeholders. Although some participants expressed a desire to invest in telemedicine, there were some participants who felt that ownership of the technology would be better received if it emerged from within the community. As one administrator said:

‘They’re very, very proud people. If it’s a way that you could grow it within the community instead of dropping it like a parachute into the community, it would enhance reception.’

Alluding to the fact that the adoption of telemedicine rests on investments by people who are going to use the system, one nurse educator said:

‘You have to have buy-in from people who are going to use the system if you want them.’

When asked for suggestions, one physician said:

‘They ought to get a (local) physician involved and the physician’s job ought to be to drag other physician’s to it (telemedicine) and make them go through the learning process - which no physician seems to like - and use it more...most doctors hate to be beginners.’

Discussion

Currently, very little is known about how health providers in rural settings will utilize telemedicine
technology. The results of this study show that participants can vary widely in their receptivity towards the introduction of telemedicine. The seven themes that emerged from our data provide a framework for understanding receptivity to telemedicine in a rural health care setting. While each of the themes have been noted to a varying degree in the literature,\textsuperscript{6-13,17} taken together, these themes represent important contextual elements of the culture and climate of the rural health environment.

While recognizing that technical issues such as user-friendliness of the technology can also be perceived as a barrier or a facilitator towards implementing telemedicine, the elemental themes that emerged from our data help us to look at the broader structural and attitudinal conditions of the environment into which telemedicine is being introduced. In addition, these themes can be considered as a sequential series of issues when developing a plan for introducing telemedicine. Beginning with the theme of practice integration, they follow a logical order for assessing environmental conditions. Specific questions can then be designed to aid in this process as shown in the following examples:

1. Practice Integration - Is there a perceived need for the technology?
2. Autonomous Relations - Who is initiating the technological change and how it that perceived?
3. Apprehension of Technology - What is the level of anxiety towards using the technology?
4. Accommodation to Change - How flexible are users towards technological change?
5. Time to Employ - How is the time expended to utilize the technology perceived?
6. Pace of Change - How is the rate of technological change perceived within the community?
7. Ownership of the Technology - Who manages and supports the technology?

Answers to these questions can assist in the development of specific strategies for implementing telemedicine. In turn, these strategies could be tailored to fit the perceived needs and concerns of each rural practice. In this way, the strategies will have some of the necessary ingredients for developing a
successful recipe for change.

**Key Messages**

How health providers in a rural setting perceive the introduction of telemedicine affects their reception of the technology.

The structural and attitudinal conditions of the rural practice environment help provide a framework for understanding how telemedicine will be received.

Strategies for initiating change need to incorporate the contextual elements of the culture and climate of the rural practice environment.

**References**


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TELEMEDICINE AT THE CROSSROADS: THE INTRODUCTION OF TECHNOLOGICAL INNOVATION IN A RURAL HEALTH CARE SETTING

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**Introduction**

Healthcare wastes as much as $270 million on inefficient computer systems and yet healthcare still lags far behind other data-intensive industries such as the airline or banking industries (Menduno, 1998). A 1995 national survey of 579,000 physicians, revealed that fewer than 5 percent of those surveyed used computer technology for such routine office chores as patient billing (Bergman, 1995). Telemedicine, or ‘the electronic transfer of medical information to remote sites to support patient care and medical education’ (Norton, et al., 1997, p. 197), has experienced rapid growth in technological capabilities, however, many rural hospitals are not taking full advantage of the $60 million they spend a year on telemedicine (Doyle, 1996).

Technology is a key governing force in society. Some may even argue that technological change drives social change (Smith, 1996). Thus the importance of technological change has captured the interest of many researchers who endeavor to understand the diffusion of technological progress (Rogers, 1995).

The University of Missouri-Columbia’s Telemedicine Demonstration Project was developed in December of 1995 to address rural health care provider needs such as isolation, lack of communication, rapid access to updated medical information, contact with colleagues, and continuing medical education opportunities. The Missouri Telemedicine Network (MTN) includes two components: video conferencing and computer infrastructure. Funding for the project came, in part, from the Rural Telemedicine Grant Program and the National Library of Medicine (NLM), with the stipulation that the University would provide a thorough evaluation. Thus, the evaluation portion of the Telemedicine program is referred to as the Rural Telemedicine Evaluation Project. The computer infrastructure portion of the project ends in September 1999. The three communities will be allowed to retain all the
hardware and software that has been provided them, but will be required to pay for the use of the T1 lines that have been installed for Internet connectivity.

Research on the acceptability of telemedicine as a particular form of technology is limited. Thus, this study was informed by literature and research related to adoption of innovations, medical educational technology, and rural health care to explore factors associated with acceptance of telemedicine by rural health care providers.

There are many issues surrounding the acceptance, or diffusion of a new technology in a rural community health setting (Rogers, 1995). The rapid pace of technology is slowed only by its acceptance (Granade and Sanders, 1997), and while the technology itself is impressive, it is ultimately the human engineering and infrastructure that will determine the effectiveness of telemedicine (Yellowlees, 1997). The purpose of this research was to assess the utilization of telemedicine in rural practice settings and develop an explanatory model.

**Literature Review**

Isolation, lack of communication, difficult access to updated medical information, and lack of continuing medical education opportunities contribute to low retention rates and shortage of supply of rural health care providers, particularly physicians (Conte, Imershein, and Magill, 1992; Harned, 1993; Mackesy, 1993; Forti, Martin, Jones, and Herman, 1995; Anderson, Bergeron, and Crouse, 1994, Harris, 1999). More and more health professionals, however, are turning to interactive telemedicine services in the delivery of health care. The spirit of telemedicine is the reciprocate of information at a distance. This includes information by voice, image, or medical records (Coiera, 1995).

*Computer Technology:* The Internet and World Wide Web can provide ‘just-in-time’ training and information on virtually any disease or health regimen imaginable for both health professionals and
patients. E-mail technology provides a new avenue for communication amongst and between various health professionals and patients. The Internet has been heralded as a revolutionary technology (Lowe, Lomax, and Polonkey, 1996; Graves, 1996; Gallagher and McFarland, 1996; Lundberg, 1998), with the potential to improve the care provided to patients and to enhance biomedical research by connecting practitioners to the most up-to-date information available (Gallagher and McFarland, 1996). With nearly 110,000 American physicians routinely using the Internet in 1995 (Engstrom, 1996), some believe that Internet technologies will even ‘alter the pattern of interpersonal relationships between human beings’ (Pareras & Martin-Rodriguez, 1996, p. 216). There have been some physicians that have used electronic mail to communicate with their patients (Neill, Mainous, Clark, and Hagen, 1994; Engstrom, 1996), claiming that it has saved time and money through the handling of non-emergent care and communication of tests results (Green, 1996).

**Video Conferencing Technology:** Telemedicine can serve as a tool to help manage the medical and financial risks of providing care to rural and under served patients (Perednia and Allen, 1995). Telemedicine, through video-conferencing, has been successfully utilized throughout the United States in various health applications such as dermatology (Norton, et.al., 1997; Menn and Kvedar, 1995), psychiatry (Callahan, Hilty and Nesbitt, 1998; Cukor, et al., 1998; Ball and McLaren, 1997; Graham, 1996; Baer, et.al, 1995; Brown, 1995), pulmonary medicine (Pacht, et.al., 1998), and cardiology (Tsagaris, et.al., 1997; Afset, Lunde, and Rasmussen, 1996; Grigsby, et.al., 1995) to name a few. There is also an educational effect to extended use of telemedicine. A General Practitioner in Norway reported that after using telemedicine ENT services since 1992, by 1997 he was able to diagnose and treat 50% of the patients himself without consulting the specialist. When included into the economic analysis, this effect, known as ‘knowledge transfer,’ contributed to making telemedicine the cheapest
method of providing ENT consultations for patient workloads above 52 patients per year (Bergmo, 1997).

**Brief history of Telemedicine:** One of the main goals of telemedicine is to make an impact on improving rural health care. The history of telemedicine extends back to the 1950s when the University of Nebraska, using two-way closed circuit television transmitted by microwave, extended psychiatric services and primary care, along with a teleradiology service to rural areas within the state. Also, during the late 1950s, a joint telemedicine project between the National Aeronautics and Space Administration (NASA) and the Public Health Service began. The equipment used included radiographic and electrocardiographic capabilities, and provided two-way video medical care. The system functioned for more than 20 years before funding ceased. Lately, there has been a resurgence of interest in telemedicine technologies, particularly surrounding the interactive video transmission component of telemedicine (Crump and Pfeil, 1995). It is still unclear, however, what kind of an impact it is having on rural health care.

**Physician Practice Behaviors and Resistance to Change:** Telemedicine provides an information technology that can aid the physician in several ways. From the video-conferencing standpoint, it can provide consultation with specialists, but perhaps the most advantageous for the physician is the computer component of telemedicine. The computer information technology can give the physician access to electronic medical records, electronic consultations, access to updated medical information and research, and provide continuing medical education opportunities. However, physicians often fail to embrace information systems when they perceive the system to be complex, do not see its relevance to their practice, and are generally disinclined to spend the time needed to be trained in its use (Treister, 1998). Although information technologies have the potential to help the physician, the most often cited
barrier to the successful implementation of particular information technology, the computerized medical record, has been the resistance of the clinicians themselves (Gleiner, 1996).

Research has shown that changing physician behavior is a very daunting task (Greco and Eisenberg, 1993; Davis, et.al., 1995; Robertson, Baker, and Hearnshaw, 1996; Treister, 1998; Gleiner, 1996; Noble, 1996). There are many reasons for this reluctance to change.

The assumption is often made that if telemedicine can simply be made available to health professionals, then somehow these people will automatically accept and use it successfully (Yellowlees, 1997). However, some rural physicians may feel that telemedicine is an intrusion on their territory by the urban tertiary care center (Carlson, 1994).

There must be at least one physician who is trained in using telemedicine, that has been able to alter the work habits and patterns so that the addition of telemedicine does not add to already overburdened workloads. However, all too often, ‘ownership’ of the telemedicine system is not translated from the initial project leader to other physicians, and the systems are managed from the ‘top down’ rather than from the ‘bottom up’ (Yellowlees, 1997).

**Study Purpose:** The purpose of this study was to investigate the consequences of introducing telemedicine into a rural health care setting and to develop an explanatory model of change that explicates the essential elements associated with the process of adopting telemedicine. An additional goal of this study was to generate strategies for change which would facilitate this process in a rural primary care practice setting.

**Methods**

**Study Design:** This study gathered qualitative data from semi-structured interviews. The structure of the interviews was developed from initial pilot interviews with information specialists and current
Missouri Telemedicine Network participants to identify suitable questions that would be useful in evaluating the adoption of telemedicine technology. Interview data were then linked to quantitative data gathered on the RTEP workstation.

**Study Setting:** Data were gathered on the computer component of telemedicine, which contained the RTEP workstation, from ten general practice clinics located in four communities with populations ranging from 3-8,000. Four of the practice clinics were affiliated with the University and six of the clinics were private practice clinics. These four communities were located in three rural counties that have total populations ranging from 13,853 to 15,322. These communities were chosen from the existing MTN network, which had the video-conferencing component installed during the first quarter of 1996. The video-conferencing component of telemedicine was installed in the hospitals located in each of the four communities and one large group practice clinic. All the physicians had access to the video-conferencing system and information specialists were retained in the community to provide just in time training at the point of need.

**Study Subjects:** A sampling matrix was developed that included a list of physicians, nurses, and administrative staff from each of the ten practice clinics. All of the physicians and at least two nurses and administrative staff from each clinic were selected to be interviewed. The interviews were conducted in the offices of each clinic. Data collection occurred between March 1998 and July 1998.

**Instrument and Data Analysis:** After consenting to participate, participants were asked open-ended questions regarding both the video and computer components of telemedicine. Each participant was asked the following questions: What do you perceive are the advantages and disadvantages of the telemedicine technology?; What do you perceive are the barriers and facilitators to using the telemedicine technology?; How do you utilize the telemedicine technology?; Can you describe the ways
in which the telemedicine technology has changed your role?; How has the telemedicine technology affected the quality of care you deliver?; and Do you have any suggestions for improving the telemedicine technology? Demographic information was collected at the end of the interview.

The interviews were transcribed and entered into a computer textual database program, Ethnograph (Sidel, et al., 1995). The text of the Interviews was divided by the type of technology being discussed (i.e., video-conferencing or the computer component) and a template analysis was used to organize and segment the data in order to identify major categories and common issues across the categories (Crabtree & Miller, 1992). An analysis template was first defined based on our understanding of the issues. These initial groupings or codes were then revised based on reading and sorting the text of the interviews. Multiple readings and codes of the transcribed interviews plus independent reviews by a panel of information specialists and health providers resulted in the identification of salient themes and issues (Miles & Huberman, 1993).

In addition to the qualitative data collection and analysis, specific quantitative outcome data were obtained for each participant. Specific outcome measures included utilization of the World Wide Web (WWW) and e-mail communications through the RTEP workstation. The data were collected automatically from the file servers located in each county. The number of pages accessed (hit) via the WWW were attained, along with the number of e-mail messages received and sent, excluding the RTEP listserv messages. These data were aggregated from the time the system was installed through February 1999.

Following the work done by Miller, et al. (1998), an analysis was completed at the practice level. Primary care practices can be understood as dynamic complex adaptive systems that develop a particular shape as determined by its primary goals (Miller, et al., 1998). To assess practice variations
on the computer component of telemedicine the final codes for each individual interviewed within each of the ten practices were entered into an Excel spreadsheet, along with specific measures to characterize the practices. These measures included the physician specialty, age, board certification, number of physicians in the practice, whether or not the practice employed a nurse practitioner, the proportion of Medicare and Medicaid patients seen by the practice, the physicians’ length of practice, and whether or not the practice was affiliated with a tertiary care center, plus utilization of e-mail messages sent, received, and WWW pages accessed. Although time did not permit direct observations of each practice over time, these measures at least provided a skeletal outline for profiling each practice.

**Results**

A total of 57 interviews were completed. This included 13 physicians (9 males, 4 females) with an average age of 52 years and an average length of practice of nineteen years. Twenty of the interviews were with nurses or nurse practitioners (17 female, 3 male) with an average age of 43 years. Twenty-four interviews were with the administrative staff (18 female, 6 male) with an average age of 45 years.

With respect to telemedicine utilization, Table 1 shows e-mail and WWW utilization by individuals in each practice. The data reveals the discrepancies in the number of e-mail messages sent versus e-mail messages received. Physicians in particular received more e-mail messages than they sent. With the exception of one physician, all the other physicians received more e-mail messages than they sent. Nine out of the thirteen physicians used the WWW, however, two of those physicians used the WWW on the same day, which may indicate that their utilization consisted only of their training session.

[INSERT TABLE 1]
To better understand the process of change, we will present a brief description of each practice followed by information regarding the utilization of the telemedicine technologies (see Table 1) and a description of each practice based on some of the categorical codes developed to analyze the interview data.

**Practice Descriptions**

Practice One is affiliated with a public tertiary care center, is board certified in the specialty of Family Practice, and has a nurse practitioner in the office. There is only one physician in this practice, serving approximately 38% Medicare patients and 6% Medicaid patients. The physician obtained his medical license in 1969. The employees in this practice appear to utilize the WWW technology. However, the physician utilized the WWW technology only one day, which may mean that his total utilization is attributed to training. The office manager clearly utilizes the e-mail technology more than the other employees do (Table 1). Advantages of the video and computer telemedicine technologies were mentioned fourteen times, including categories such as saving the patient from having to travel (mentioned 6 times), access to specialty care (mentioned 4 times), the convenience of follow-up care (mentioned once), educational opportunities for all staff (mentioned once), and access to information (mentioned twice). The only disadvantage mentioned in the interviews for the entire practice was by the physician regarding technical problems he had experienced. Barriers were spoken of twenty times. The most frequently listed barriers of the telemedicine technologies were ‘integration’ (referring to the technological fit within the organization) and ‘impersonal’ (referring to the lack of social intimacy). ‘Apprehension,’ or anxiety toward technological change was also a frequent barrier brought up by members of this practice. All respondents, except the physician responded that the video conferencing portion of telemedicine could provide the same quality of health care as face to face care. The physician...
expressed that the video conferencing could ‘sometimes’ provide the same quality of health care.

Practice Two is affiliated with a private tertiary care center, is board certified in the specialty of Family Practice, and has a nurse practitioner in the office. There is only one physician in this practice, serving approximately 10% Medicare patients and 30% Medicaid patients. The physician received her medical license in 1996. Only two employees of this practice are participating in the RTEP – the physician and the nurse practitioner. The physician appears to have low utilization, however, she has a second e-mail account through another Internet provider. Clearly, the nurse practitioner utilizes both the e-mail and WWW components of the RTEP workstation. A variety of advantages were named by the physician in this practice regarding both the video and computer components of telemedicine. These included the access to specialty care, convenience of follow-up care, educational opportunities for all staff, the facilitation of communication, access to information, and the teleradiology services. Only three disadvantages of telemedicine were identified. The physician identified the technological problems she had experienced with the technologies, and the ‘slowness’ of the technology. The nurse practitioner expressed the disadvantage of the design of the keyboard, and how it was not suitable for the elderly. The most frequent identified barriers were ‘impersonal,’ referring to the lack of social intimacy the technology imposes, and ‘apprehension,’ referring to the anxiety toward technological change. The rural culture and the rate at which change occurs in that culture were also identified as barriers to the acceptance of the telemedicine technologies. Neither the nurse practitioner nor the physician expressed that the adoption of telemedicine would change their current role as a health care provider, except in the sense that it might make their job easier.

The physicians in Practice Three are in private practice, specializing in Internal Medicine. However, only one physician is participating in the RTEP. Nearly half of their patients are on Medicare,
and approximately 15% of their patients are on Medicaid. The nurse practitioner in this office only works half time. The physicians both received their medical license in 1979. The office staff person utilizes the WWW technology, but does not appear to utilize the e-mail component of the RTEP workstation. The physician who was interviewed from this practice did not list any advantages to either telemedicine technology, but did list technological problems as a disadvantage. ‘Integration,’ or the technological fit within the organization was the most frequently identified barrier to the acceptance of telemedicine within the practice. ‘Impersonal’ was also identified as a barrier, along with ‘Disinclined’ (not interested), Referral (the existing referral patterns of the physician), no perceived need for the technology, scheduling, and training. The physician did express her belief that the same quality of care could come from using telemedicine as in face to face health care.

The physician in Practice Four is in private practice, not affiliated with any tertiary care center. He is board certified in Family Practice, received his medical license in 1983, and approximately 75% of his patients are on Medicare. The remaining patients are through Medicaid. He does not have a nurse practitioner through his office. All three RTEP participants from this office utilize the WWW technology, and none of them utilize the e-mail technology. The physician was the only employee in this practice that was interviewed. He acknowledged the educational opportunities for staff, both physicians, nurses, and administrative personnel as the only advantage to telemedicine. The main disadvantage identified was the lack of the ability to have ‘hands-on’ touch using the technology. ‘Integration’ (the technological fit within the organization) and ‘competency’ (lack of proficiency) were the two main barriers to acceptance of the technology mentioned by the physician, however he did feel that the same quality of care could come about through telemedicine as through face to face health care visits. He did not foresee any role changes as a health care provider as a result of utilizing telemedicine.
The physician in Practice Five is affiliated with a private tertiary care center, is board certified in Family Practice and received his medical license in 1971. Close to half of his patients are through Medicare and approximately 3% are through Medicaid. There is no nurse practitioner through this office. The office manager within this practice utilizes both the e-mail and WWW technologies more than the others, however, based on an interview with the physician, it was determined that he does use the WWW without going through the RTEP workstation. If the participant uses the WWW without going through the RTEP workstation, there is no way for the proxy server to track utilization. There were no advantages to telemedicine identified by either the physician or the office manager (who use the RTEP workstation), however there were several advantages listed by the nurse and secretary. These were patient education, educational opportunities for staff, and the ability to communicate. ‘Lack of equipment’ and ‘security’ were identified as disadvantages. ‘Apprehension,’ (anxiety toward technological change) ‘competency,’ (lack of proficiency) and ‘time’ (a finite resource in which the participants have to learn and utilize the technology) were the most frequently identified barriers to the acceptance of telemedicine. Other barriers identified were ‘integration,’ (technological fit within the organization) ‘Impersonal,’ (lack of social intimacy) ‘learning,’ (refers to the understanding or awareness of the technological capabilities and limitations) and ‘responsibility’ (added responsibility). The office manager reflected ‘ownership,’ (there is an investment in the technology, to the point that they become stakeholders) and identified ‘prior experience’ (with computers) and ‘planning’ (of the implementation and training process of the technology) as the main facilitators to her acceptance of the technology.

Practice Six is affiliated with a public tertiary care center. The physician is board certified in Family Practice, does not have a nurse practitioner, approximately 80% of his practice are comprised of Medicare patients and 5% Medicaid, and he received his medical license in 1981. The office
manager/nurse utilizes the WWW technology, but has very low e-mail utilization. The physician in this practice identified advantages of telemedicine in terms of saving travel for the patient and access to specialty care. The main disadvantage of the Internet technology was the accuracy of web-based information, but no disadvantage of the video conferencing was identified. However, the barriers to the acceptance of telemedicine were many. The most frequently cited barriers were ‘integration’ (the technological fit within the organization), ‘impersonal’ (lack of social intimacy), no perceived need for the technology, and the rate of change in a rural culture. This physician does not use either the video conferencing or the Internet components of telemedicine.

There are two physicians of Internal Medicine in Practice Seven. They are in private practice and are not board certified, receiving their medical licenses in 1980. Approximately 60% of their patients are through Medicare and 10% are through Medicaid. There is no nurse practitioner in this office. Only one physician is participating in the RTEP project. The Secretary in the practice utilizes both the e-mail and the WWW technology. Clearly the WWW technology is utilized more than the e-mail component of the RTEP workstation. Educational opportunities for the staff was considered an advantage of the telemedicine technologies for one of the physicians interviewed. The main disadvantage for the video conferencing portion of telemedicine was the lack of the ability to have a hands-on touch. He did not believe that his role as a health care provider would change as a result of telemedicine.

There is virtually no utilization of either e-mail or WWW technology in Practice Eight. This is a private practice with one physician who is board certified in Family Practice, received her medical license in 1994, does not have a nurse practitioner through her office, and close to half of her patients are through Medicare, with another large portion of patients through Medicaid. Although the physician in this practice has not utilized the video portion of telemedicine either, she did list educational
opportunities for the staff as an advantage to both the video and the computer-based telemedicine services. She did not identify any disadvantages to the technology, but acknowledged ‘integration,’ ‘impersonal,’ and ‘scheduling’ as barriers to the adoption of telemedicine. She responded that the same quality of care could sometimes be achieved over telemedicine as in face-to-face health care.

The physician in Practice Nine is board certified in Family Practice, received his medical license in 1968, and is not affiliated with any tertiary care center. Approximately 25% of his patients are through Medicare and close to 10% are through Medicaid. There is no nurse practitioner through this office. Two of the employees in this practice are participants of the RTEP, the physician and an office staff person. Neither utilize the e-mail to any extent, however the office staff person utilizes the WWW component of the RTEP workstation. This physician did not allow for any interviews to be conducted.

There are multiple physicians in Practice Ten, two are board certified in Family Practice, one physician is not board certified, specializing in General Surgery, and one physician is board certified in Infectious Diseases. Medical licenses were obtained in 1985, 1979, 1965, and 1988 respectively. There is a nurse practitioner through this practice. Three of the four physicians utilize the WWW, however only one of them uses e-mail. The nurse practitioner uses both, as well as the administrator of the practice. The nurses and office staff do not use the e-mail, but a few have used the WWW. A wide variety of advantages were identified from the employees in Practice Ten. The most common were access to specialty care and saving the patient from having to travel to the tertiary care center. This is noteworthy because this practice is only 24 miles from the tertiary care center with which it is affiliated. Other advantages identified included: saving the physician from having to travel to the patient, convenience, educational opportunities, communication, the ability to see more patients, and teleradiology. Disadvantages identified were: the equipment is expensive, there is a lag time in the video
conferencing component, there is a lack of ability to have a hands-on touch with the patients, the size of the video conferencing units is big and bulky, time, and technical problems associated with the use of the technology. ‘Integration’ (the technological fit within the organization) was listed 13 times as a barrier to the acceptance of telemedicine. This was closely followed by 11 responses of ‘time’ and 10 responses of ‘competency’ as notable barriers. Other barriers identified include: ‘access’ (referring to the ability to utilize the equipment or technology), apathy, apprehension, complex (perceived complex process), communication, control (lack of influence the patient or physician would have over the telemedicine session), disincline (not interested in using the equipment), frustration with the system or process of using telemedicine, implementation (the delivery and set up of the technology), impersonal, no perceived need of the technology, the rate of change in a rural community, personnel (lack of available personnel to support the video technology), scheduling (the process of the planning of two or more parties to come together via telemedicine), and training (referring to the quantity and timing of the training where the purpose is developing a skill). There were nine responses of ‘yes’ when asked if telemedicine could provide the same quality of health care as face-to-face. No one answered ‘no,’ however there was one ‘sometimes’ and one ‘sufficient’ (meaning not really, but it is better than nothing) response. The majority of interviewees responded that they did not foresee telemedicine changing their role as a health care provider. Physician characteristics (referring to the personality and bedside manner of the telemedicine consultant to the patient) was identified as the most common facilitator to the acceptance of telemedicine. This clinic is currently involved in using telemedicine to conduct regular dermatological consults. The dermatologist visits the clinic through an outreach program once every two weeks. On the off week, he sees his patients over telemedicine. The physician has dynamic personal characteristics and a good working relationship with both the local physicians and his patients.
Discussion

Upon review of the utilization and interview data for each practice, several broad themes related to the introduction of telemedicine emerged: practice integration, autonomous relations, apprehension of technology, accommodation to change, time to employ, pace of change, and ownership of the technology. Each of these themes apply to the computer and televideo components of telemedicine and each may operate as a perceived barrier or facilitator of change. **Practice Integration:** Innovative technologies such as the use of telemedicine must be perceived by practicing physicians and health providers as meeting a functional need the extent to which it will have an impact on health care delivery. The efficacy of telemedicine or the ability to positively effect patient care outcome has yet to be demonstrated. Unlike the introduction of a drug or medical procedure, telemedicine represents a technology that for the most part has an indirect effect on patient care outcome. The goal of telemedicine is to enhance, streamline, or improve the process of health care delivery not necessarily the product. In the absence of having a demonstrated direct effect on patient care, telemedicine may not be readily integrated into a practice. For some of the physicians whom we interviewed there was no compelling reason to integrate telemedicine technology into their practice. One physician in private practice who rarely used the computer said:

“It doesn’t really help a lot. I think computers are good for specialists and in primary care you know basically most of the stuff - 80 to 95% of the stuff you know by now anyway - because you see it all the time. Then the other 20% of it that’s more difficult - you look it up in routine journals. And if it’s not there, if it’s not very clear and if it’s a serious problem, why that’s when I think you should send people to the specialist, because that’s what they’re there for.

While some physicians did not see a reason to change and integrate the new technology into their practice, others simply did not think of using it. They did not necessarily reject the technology. It was, as
yet, not well integrated into their practice behaviors. Regarding the video conferencing component of
telemedicine, one physician in private practice said:

“Well first, it’s a new thing and we haven’t used it in our practice and it’s hard for us to get out
of our old habits of how we do things. And so I think that’s to me a major thing. I’m talking to
the other doctors - they don’t think of it and then I mentioned it and they said - oh, it sounds like
that would be alright.”

Similarly, when asked about using the video conferencing, one nurse said:

“The doctors, getting them, our doctors here, just familiar enough to want to use it. That’s been a big
problem for us. We’ve shown it to them, we’ve had programs on it. They still don’t think of it.”

Although some physicians did not see the need for telemedicine or forgot to use it, others welcomed
it and readily saw the potential capabilities that would enhance their practice. In most instances, these
physicians had an established affiliation with a tertiary care center where computer technology played a
prominent role in the delivery of patient care. One primary care physician affiliated with a large tertiary center
said:

“...the computer - just get us hooked up to the University. What I’d like to do with the University
- I’d like to be able to find out people - like I’m not real familiar with a lot of doctors down there-
the doctors change a lot - the names and the departments...I need to know how to find e-mails on
some of the doctors who I’m going to use them. What I need is to be able to get stuff
out...because Medical records down there is slow. I need to be able to get into the medical
record. I don’t know what they’re going to do with confidentiality stuff, but I need to be able to
pull a chart up. I need to be able to pull records and stuff like that. If someone’s been at the
University - progress notes, whatever lab test - that kind of stuff. I need to be able to go to the
computer and pull it out. That’s what I need.”
Regarding the video conferencing, one physician also affiliated with a tertiary center decried the lack of use of the equipment by some of the physicians associated with the local hospital said:

“Hell, if the other guys (in the rural hospital) aren’t going to use it, just bring it down here and let me use it. I could probably utilize it a heck of a lot better than they could. If they’re not willing to...cause I’ve told them over and over, ‘See it’s really nice. It’s a convenience for the patient.’”

**Autonomous Relations:** While perceived functional need is an important ingredient in the acceptance of telemedicine, there are other factors to consider as well. Viewing a physician’s practice as an organic whole that operates not only on the basis of an internal organizational interactive system with unique properties and relations, but operating in a broader social context as well, lends insight into the success and failure of implementing the technology. A physician’s practice is enmeshed in a network of social relationships. If it is a private practice it functions as an autonomous unit that has external relations with other health care providers and systems based on established patterns of referral and consultation initiated by the physician. If it is a satellite practice with direct ties to a larger health care system then the established patterns of referral and consultation are inherited as part of management of the larger system.

The theme of autonomous relations refers to the degree to which participants perceived telemedicine was an intrusion on their territory by a tertiary care center (Carlson, 1994). While some participants saw the technology as a, “good thing... it was nice to be connected to a big University,” others saw it as a potential threat to their sense of competency, autonomy, and livelihood (Greco & Eisenberg, 1993). One office staff participant said:

“Some of the disadvantages have been, that I’ve seen, are the perception that possibly they’re, the work
professionals, are not seen as practicing their craft correctly. That they’re not up to speed and that’s why this has come out here.

When change such as telemedicine is introduced into a rural setting from outside the community there may be a perceived potential threat to autonomy. A nurse practitioner alluded to this when she said:

“We are rural. We are mostly average to below-average income. And I think the way somebody comes from a university with a new idea to fix or to help, depending on one’s perception, can make a big difference in how something new is perceived and received. So I have experienced times when, although the intentions were good, the community has rejected it hands-down because they didn’t need help from the outside.”

In a similar context, the introduction of telemedicine may be perceived as a potential threat to one’s livelihood. One staff member commenting on the problem of reimbursement for the video conferencing component of telemedicine said:

“So then I question why aren’t the doctors using it? Is it a money issue?...’Well, how do we get paid for it’. And we didn't actually see the patient, they [the university] did. But yet we want to be reimbursed for our time that was spent. And I think that that's one of the issues that's still being discussed and figuring out how to solve that issue, because you do have, you know, you're going to have an LPN or an RN that's running this equipment so you have that expense of that person and so how do you justify that expense when you're really not being reimbursed for it or they don’t see how they can be reimbursed.”

**Apprehension of the Technology:** For many of the participants in our study the implementation of telemedicine led to some anxiety about using the new technology. As one nurse practitioner said:

“I guess the number one (barrier) would just be anything that’s new or different often seems to cause some hesitation or almost an automatic dislike in many folks.”
“People are scared of technology” said one physician. “Computer phobia,” for example, is something that has to be overcome. In response to the question on barriers to using the RTEP workstation, one nurse said:

“Mostly just the lack of knowledge of how to run a computer. Mine at home is just basic. I don’t have any of this fancy stuff. But, I don’t get on it too much. I’m always afraid I’ll push the wrong button and delete something, and get into something I’m not even hooked up to and all of a sudden something will come up and it will say illegal action. It scare me. I think ‘Oh my gosh I’ve done something against the law,’ you know. I think that would be the worse, people not understanding it and what to use if for. This is hard.”

Likewise, some of the participants were apprehensive of using the video conferencing technology. One physician said:

“A lot of it is just still overcoming some of the initial hesitation to use it on both the consultant’s and the referring doctor’s part, convincing each party that you can get good information and data from such interchanges and that it’s not as complex as it seems at first.”

Along with the anxiety that telemedicine technology may bring to the rural practice, there was a concern about the validity of the information that was being provided over the Internet. A physician who was reluctant to use the RTEP workstation said:

“The biggest thing I have with it (the Internet) is you don’t know [what] you’re getting – who’s writing the articles, you know, and I, I prefer software through Scientific American that I use and know those people are supposedly respectable researchers. You know what you get is good. You just pull it off the Internet and you have no idea where it’s coming from and there’s a lot of stuff on the Internet that’s no good.”
In addition, while some physicians remained apprehensive towards utilizing telemedicine, they were willing to let others in their practice learn and use the new technology. A physician in private practice said:

“I think I’m going to leave that up to my people. The only interest that I have is, uh, just to get some medical literature when I need some topic, that’s the only thing. But one of my people, she is into that, you know, in the computers. I’m sure she’s going to be wanting to learn it.”

**Accommodation to change:** Physicians by training are taught to be conservative in their management of patient care and to above all do no harm. In this context, it is not unreasonable for physicians to approach telemedicine with reticence, as they would approach any innovation in health care that signals a change in practice behavior. If the innovation has the perceived potential of disrupting current practice behaviors without an immediate corresponding positive improvement in the delivery of patient care then physicians are less likely to accept or adopt the innovation.

The theme of accommodation to change refers to the ability to adjust to technological change. The introduction of a new technology often requires individuals to accommodate to disruptions in habitual ways of doing things (Arthur, 1996, Treister, 1998). With respect to the change in practice behaviors that telemedicine may bring, several of the participants were reluctant to alter their practice. A physician in private practice said:

“We don’t wanna change. Everybody’s just fine the way it is...I’m not prepared for this.”

Similarly, another physician in private practice said:

“...as a group we have a tendency to be pretty stuck in our ways and have a pretty firm resistance to change.”

One physician in private practice who recognized the possible need to change but remained
inflexible said:

“Much like me with the computer. I don’t want to take the time to learn and the way I’ve always done it is the best way and you know that’s pretty antiquated. I know I do it.”

While some may be reluctant to change, others remain skeptical in their approach toward adopting any new technology but are willing to consider its potential. One primary care physician reflected on the changes he has undergone since graduating from medical school:

“I can remember reading, you know, histories of medicine and stuff like that when I was a pre-med student and thinking to myself now, you know, ‘Gee, this is awful. And I’ll never be that way. When I get to be a doctor, I’ll be different.’ And I have to remind myself of that almost on a daily basis. You don’t want to jump in with both feet on every new thing that come along, because some of it turns out to be no good, you know. And if you buy all that stuff, you can go broke easily. But when something, you know, really looks like it’s becoming mainstream, then you can get on the bandwagon or else the parade’s going to leave you behind.”

Some participants, however, did see the need change. One physician who disliked computers, yet saw the need to learn it said:

“Well, I really don’t like it because it’s not my type of thing, but I’m going to have to learn it.”

Time to Employ: In a busy rural primary care practice, time is a scarce commodity. In this context, the theme of time refers to a finite resource in which the participants have to learn and utilize the technology. Unfortunately, computerized information technology has an initial learning curve that requires considerable time and effort. Efficiency is an important aspect of this theme. As one nurse/office manager said about the computer:

“It takes time to learn to use it and to do it. And you spend a lot of time doing it. And where if I’m looking
up something in a book, maybe the book is old, but at least I could have it done in five minutes. And now, until I get good at this, you know, it’s taking me much longer.”

The video conferencing component of telemedicine was also seen by some participants as an intrusion on their time. As one physician said:

“Well, this is kind of like a rural community, you know, and sometimes it takes a lot of time to pursue it with the patient. They will get the same type of care if they would see the physician personally. So, actually it takes lots of our time sometimes, you know, of our appointments just to pursue them to come for a telemedicine appointment.”

While some participants saw telemedicine as an intrusion on their time, others recognized the potential time-saving features of telemedicine. An administrator who identified the potential benefits of the computer said:

“Everybody’s pretty interested in it...I think everybody’s kind of getting in to it because then you’re going to be able to correspond a lot without having to send memos and stuff and you can do it through the computer and save a lot of paper and time.”

Correspondingly, a physician noting the advantages of video conferencing said:

“Time advantages, convenience advantages so people won’t have to travel...That’s always very much appreciated by the people that we refer. They say, “Oh, you mean we can see a specialist without having to go to (the tertiary center)? I have a lot of older patients that appreciate not having to travel that distance. I think those are all the added benefits of it”.

Pace of Change: Several of the participants in the project mentioned the slower rate of change that occurs in rural communities. Technological change moves at a slower pace than in urban communities. One nurse practitioner in the study said:
“I think that in general the community is pretty much behind the nation as an average, using technology. We got 911 three years ago. Three years before that, we finally had a seven-digit phone number. So, I think it’s very possible to make the change, but I think that the expectations for the rate of change and the learning curve should be pretty generous.”

Not only did the participants acknowledge the slower pace of technological change that occurs in rural settings, but they acknowledged the slower pace of gaining acceptance in a rural culture as well. A primary care physician alluded to this when he said:

“Background is extremely important to what’s accepted. And although you move into the community and you can be here 20 years, you’re an outsider. And if you are not sensitive to that, you can make some really big errors not knowing it.”

Although some participants noted the slower pace of change in a rural community, several participants were positive that telemedicine would eventually catch on. When discussing the impact of telemedicine, one administrator said:

“I think we’re starting to see that we’ll have a network of computers where we can talk to nursing homes locally, talking with physicians offices, and transporting data back and forth as far as lab tests and patient information. I think that’s going to expand faster, probably faster that the actual (video) portion for us.”

Ownership of the Technology: This theme refers to the degree to which participants are invested in the technology to the point that they become stakeholders. Although some participants expressed no desire to invest in telemedicine, there were some participants who not only acknowledged its potential benefits but adapted the technology to their special needs. As might be expected, this investment in the technology was usually done by those in administrative positions. One administrator who helped
develop their own policies for using telemedicine said:

“Yeah, we’ve, our group here in...on the network side developed our own policies. We took some of the modules and modified them to match what we thought. And we really had good success, we had everybody buy into using the same policies, so we didn’t have a problem there.”

Those who have an investment in the new technology also want to encourage others to use it. This was evident when an administrator who encouraged the more use of the computer said:

“I don’t worry about the members of this group using it in a negative way. I want them to utilize it more, even if they’re getting on an using it for recreational activities. The more exposure that they have to it, the more accustomed they’re going to be to using it and I don’t think that they waste their time, I encourage them to get on there and look around to see what they can find. Especially as it relates to their job.”

Explanatory Model

The seven themes that emerged from our data provide a framework for understanding some of the consequences of introducing telemedicine into a rural health care setting. While each of the themes have been noted to a varying degree in the literature (Grecco & Esenberg, 1993; Yellowless, 1997; Mazmanian, Banks, Self, and Hampton, 1996; Menduno, 1998; Treister, 1998; Appleby, 1997, Keoun, 1996; Chi-Lum, Lundberg, and Silberg, 1996; Bergman, 1995; Arthur, 1996), taken together, these themes represent important contextual elements of the culture and climate of the rural health environment. However, the results of this study are confined to the consequences of the early introduction of telemedicine technologies into rural practices settings. In many ways, they represent the perceptions of health care providers as they begin to adjust to the new technologies. Moreover, while the pace of change in a rural community as perceived by the participants was considered slow when
compared to change in urban communities, there is no reason to believe that similar consequences would not be perceived with the introduction of new technology in an urban setting.

While recognizing that technical issues such as user-friendliness of the technology can also be perceived as a barrier or a facilitator towards implementing telemedicine, the elemental themes that emerged from our data help us to look at the broader structural and attitudinal conditions of the environment into which telemedicine is being introduced.

In many ways the introduction of telemedicine into a rural health care setting is analogous to what happens when managed care is introduced into rural areas. According to Gibbons (1998), while some rural health providers perceive managed care as an opportunity to enhance community development through reshaping and revitalization of the rural delivery system, others see it as a system that will gobble up the rural systems and patients, taking the local health care dollar away. Similarly, telemedicine may be perceived as an opportunity to enhance the delivery of health care or it may be perceived as not essential at best or, at worse, perceived as a threat. Clearly, the initiation of telemedicine in a rural practice does not occur in a vacuum and knowledge of the environmental conditions, both structural and attitudinal, surrounding the practice plays a vital role in determining the potential for success in adopting telemedicine.

In this context, the seven themes identified in our study provide some of the essential ingredients for understanding the process of technological change in a rural health care practice. Viewed as a continuum, acceptance of telemedicine is more likely to occur when there is a greater organizational integration of the new technology, a perceived increase in time efficiency, greater affiliation with a tertiary care center, a perceived increase in ownership, an enhanced ability to accommodate the changes, a reduction in apprehension, and the realization of the pace of change in a rural community.
Likewise, telemedicine is less likely to occur when there is a lack of organizational integration, a perceived decrease in time efficiency, no affiliation with a tertiary care center, a perceived lack of ownership, an inability to accommodate change, an increase in apprehension, and a lack of understanding the pace of change in a rural community.

Following the work of Donabedian (1985), the themes identified in our study can be adapted to an explanatory model that clarifies their relationships. As Figure 1 shows, the degree of telemedicine utilization (outcome) is dependent on the characteristics of the rural health care practice (structure) and the organizational reconciliation to the introduction of telemedicine (process) that occurs within the rural setting (context).

[INSERT FIGURE 1]

Strategies for Change

The introduction of telemedicine is like an exercise in foreign relations wherein a dominant culture (tertiary care center) attempts to introduce technological change into an autonomous entity (private rural health care practice) (Hey, 1997). Policy behavior needs to be cognizant of the existing system of rural relationships and culture. It is the constituent elements of the environment that potentially allows telemedicine to ‘take root’ and grow, which results in a positive impact on the issues previously identified regarding rural health care. Recognizing the variability in rural practices and practice behaviors, the environmental conditions of the ten practices we studied can be logically grouped into three categories: practices that are very fertile for the implanting of telemedicine, practices that are somewhat
fertile for the growth of telemedicine, and practices that are infertile for the growth of telemedicine. For each of these three conditions, strategies for change can be developed that enhance the potential for the growth of telemedicine in a rural practice as illustrated in Table 2 (Kanter, 1989; Beer, Eisenstat, and Spector, 1990; Kotter, 1995).

[INSERT TABLE 2]

**Conclusion**

Perhaps the single most important lesson to be learned is that implementation strategies need to be tailored to the environmental conditions of the targeted health care agency. It is apparent from our study that the selection of the targeted health care agency (identifiers) is critical to the potential growth of telemedicine. Clearly, focusing on those environmental contexts of the health care agencies that are most receptive (fertile) to telemedicine become exemplars to the proficiency of the benefits of telemedicine.

Establishing relationships with a targeted health care agency begins with the process of negotiation, which involves a diplomacy that allows for a sensitivity to unique local conditions. A commitment must be made to nurture the relationship in order to allow for sustainability.

The true impact of telemedicine has yet to be realized. However, the potential is there, should these themes be recognized and strategies followed, for a positive impact on rural physician isolation, lack of specialty care, access to medical information, and continuing medical education opportunities.
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Table 1: Utilization of computer-based telemedicine

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<thead>
<tr>
<th>Practice</th>
<th>E-mail sent</th>
<th>E-mail received</th>
<th>WWW hits</th>
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<td><strong>Practice 1</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Physician</td>
<td>0</td>
<td>10</td>
<td>53 (same day)</td>
</tr>
<tr>
<td>NP</td>
<td>2</td>
<td>4</td>
<td>476</td>
</tr>
<tr>
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<td>224</td>
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<td>4</td>
<td>739</td>
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<td>0</td>
<td>8 (same day)</td>
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Figure 1: Explanatory Model Illustrating the Relationships Among the Seven Themes

<table>
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<tr>
<th>CONTEXT OR SETTING</th>
<th>PRACTICE STRUCTURE</th>
<th>ORGANIZATIONAL PROCESS</th>
<th>OUTCOME</th>
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<td>Practice Integration</td>
<td>Time to Employ</td>
<td>Degree of</td>
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<td>Autonomous Relations</td>
<td>Accommodation to Change</td>
<td>Ownership of the Technology</td>
<td>Telemedicine Utilization</td>
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<td></td>
<td></td>
<td></td>
<td>Direction of Technological Change</td>
</tr>
<tr>
<td>Fertile Soil Identifiers</td>
<td>Partly Fertile Identifiers</td>
<td>Infertile Soil Identifiers</td>
<td></td>
</tr>
<tr>
<td>--------------------------</td>
<td>----------------------------</td>
<td>---------------------------</td>
<td></td>
</tr>
<tr>
<td>Affiliated with a public tertiary care center – access to public funds</td>
<td>Affiliated with a private tertiary care center – access to private funds</td>
<td>Private practice – limited funds</td>
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</tr>
<tr>
<td>Support from parent institution</td>
<td>Contemplation of support from parent institution</td>
<td>Little support from physician – leadership</td>
<td></td>
</tr>
<tr>
<td>Uses extenders such as nurse practitioners</td>
<td>Some extenders</td>
<td>No extenders</td>
<td></td>
</tr>
<tr>
<td>Likely to have prior computer experience</td>
<td>Likely to have prior computer experience</td>
<td>No prior computer experience</td>
<td></td>
</tr>
<tr>
<td>Looks for ways to improve practice</td>
<td>Open to ideas to improve practice</td>
<td>No perceived need to improve practice – ulterior motive for technology</td>
<td></td>
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</tbody>
</table>

**Strategies for change**

Fertile Soil Identifiers:
- Involve physicians and administration in planning and implementation process
- Team building within the practice
- Coalition building with affiliate physicians
- Empower the practice by providing space for the new technology, personnel, access, and training.

Partly Fertile Identifiers:
- Establish a sense of urgency
- Team building within practice
- Coalition building within the community and specialty physicians
- Create a vision
- Communicate vision with the rest of the practice
- Empower employees to act on new vision
- Provide for short-term wins

Infertile Soil Identifiers:
- Develop perceived need for technology (present physician with statistics on medical information overload, feedback on county’s medical information, etc.)
- Involve physicians in planning process
- Empower physicians to implement technology as negotiated – provide necessary resources
- Coalition building within the community and specialty physicians
EARLY ADOPTION OF PRACTICE-BASED TELEMEDICINE
IN RURAL HEALTH CARE SETTINGS

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Introduction

Healthcare wastes as much as $270 million on inefficient computer systems and yet healthcare
still lags far behind other data-intensive industries such as the airline or banking industries (Menduno,
1998). A 1995 national survey of 579,000 physicians, revealed that fewer than 5 percent of those
surveyed used computer technology for such routine office chores as patient billing (Bergman, 1995).
Telemedicine, or ‘the electronic transfer of medical information to remote sites to support patient care
and medical education’ (Norton, et al., 1997, p. 197), has experienced rapid growth in technological
capabilities, however, many rural physicians have been slow in their acceptance of this new information
technology (Mazmanian, et al., 1996; Menduno, 1998). The purpose of this paper is to examine the
consequences of initially introducing telemedicine technology into ten rural primary care practices.

Background

Rural health communities encounter unique challenges in providing care to their population.
Recruitment and retention of rural health care professionals is difficult. Isolation, lack of communication,
lack of access to updated medical information, and lack of continuing medical education opportunities
have been identified as influencing factors that contribute to low retention rates and a shortage of rural
health care providers, particularly physicians (Conte, et al., 1992; Harned, 1993; Mackesy, 1993;
Anderson, Bergson and Crouse, 1994). The ability to deliver rural health care may suffer as a
consequence.

The Missouri Telemedicine Network (MTN) began in 1995 as a demonstration project to
address rural health care provider needs. It includes two components: a high-speed computer data
infrastructure and two-way interactive televideo links. Funding for the project came, in part, from the
Rural Telemedicine Grant Program and the National Library of Medicine with the stipulation that the
University of Missouri-Columbia provide evaluation studies. These studies were referred to as the Rural Telemedicine Evaluation Project (RTEP).

The MTN consists of twenty-one telemedicine sites throughout sixteen counties in Missouri. Four communities with populations ranging from 3-8,000 in three rural counties were chosen for evaluation. Participation was voluntary.

The televideo component of telemedicine was installed in the hospitals located in the three counties and one large group practice clinic. All the physicians had access to the video-conferencing system. The computer component of telemedicine was installed in ten general practice clinics located in the four communities. Four of the practice clinics were private practices and six of the clinics were affiliated with either public or private tertiary care centers.

As part of the computer infrastructure, an Internet-based workstation was developed, the RTEP workstation. This workstation provided e-mail, access to the World Wide Web (WWW), medical databases such as Medline, community specific information, a calendar, and access to a medical librarian. One of the main goals of the RTEP workstation was to provide networking and educational opportunities, and access to updated medical information.

Many successful innovations require a lengthy period of inception before the innovation can be considered to be accepted and to have made a desirable impact (Rogers, 1995). The purpose of this paper is to describe how the initial impact of telemedicine was perceived by physicians in primary care.

Method

Our study gathered qualitative data from semi-structured interviews. The structure of the interviews was developed from initial pilot interviews with information specialists and current MTN
participants to identify suitable questions that would be useful in evaluating the adoption of telemedicine technology. Interview data were then linked to quantitative data gathered on the RTEP workstation.

A sampling matrix was developed that included a list of physicians, nurses, and administrative staff from each of the ten practice clinics. All of the physicians and at least two nurses and administrative staff from each clinic were selected to be interviewed. The interviews were conducted in the offices of each clinic. Data collection occurred between March 1998 and July 1998.

After consenting to participate, participants were asked open-ended questions regarding both the video and computer components of telemedicine. Each participant was asked the following questions: What do you perceive are the advantages and disadvantages of the telemedicine technology?; What do you perceive are the barriers and facilitators to using the telemedicine technology?; How do you utilize the telemedicine technology?; Can you describe the ways in which the telemedicine technology has changed your role?; How has the telemedicine technology affected the quality of care you deliver?; and Do you have any suggestions for improving the telemedicine technology?

Demographic information was collected at the end of the interview.

The interviews were transcribed and entered into a computer textual database program, Ethnograph (Sidel, et al., 1995). The text of the Interviews was divided by the type of technology being discussed (i.e., video-conferencing or the computer component) and a template analysis was used to organize and segment the data in order to identify major categories and common issues across the categories (Crabtree & Miller, 1992). An analysis template was first defined based on our understanding of the issues. These initial groupings or codes were then revised based on reading and sorting the text of the interviews. Multiple readings and codes of the transcribed interviews plus
independent reviews by a panel of information specialists was done to arrive at a consensus on the codes (Miles & Huberman, 1993).

In addition to the qualitative data collection and analysis, specific quantitative outcome data were obtained for each participant. Specific outcome measures included utilization of the World Wide Web (WWW) and e-mail communications through the RTEP workstation. The data were collected automatically from the file servers located in each county. The number of pages accessed (hit) via the WWW were attained, along with the number of e-mail messages received and sent, excluding the RTEP listserv messages. These data were aggregated from the time the system was installed through February 1999.

Following the work done by Miller, et al. (1998), an analysis was completed at the practice level. Primary care practices can be understood as dynamic complex adaptive systems that develop a particular shape as determined by its primary goals (Miller, et al., 1998). To assess practice variations on the computer component of telemedicine the final codes for each individual interviewed within each of the ten practices were entered into an Excel spreadsheet, along with specific measures to characterize the practices. These measures included the physician specialty, age, board certification, number of physicians in the practice, whether or not the practice employed a nurse practitioner, the proportion of Medicare and Medicaid patients seen by the practice, the physicians’ length of practice, and whether or not the practice was affiliated with a tertiary care center, plus utilization of e-mail messages sent, received, and WWW pages accessed. Although time did not permit direct observations of each practice over time, these measures at least provided a skeletal outline for profiling each practice.
Results

A total of 57 interviews were completed. This included 13 physicians (9 males, 4 females) with an average age of 52 years and an average length of practice of nineteen years. Twenty of the interviews were with nurses or nurse practitioners (17 female, 3 male) with an average age of 43 years. Twenty-four interviews were with the administrative staff (18 female, 6 male) with an average age of 45 years.

With respect to telemedicine utilization, Table 1 shows e-mail and WWW utilization by individuals in each practice. The data reveals the discrepancies in the number of e-mail messages sent versus e-mail messages received. Physicians in particular received more e-mail messages than they sent. With the exception of one physician, all the other physicians received more e-mail messages than they sent. Nine out of the thirteen physicians used the WWW, however, two of those physicians used the WWW on the same day, which may indicate that their utilization consisted only of their training session.

[INSERT TABLE 1]

To better understand the initial impact of telemedicine on a rural practice, we will present a brief description of each practice followed by information regarding the utilization of the telemedicine technologies (see Table 1) and a description of each practice based on some of the categorical codes developed to analyze the interview data.

Practice Descriptions

Practice One is affiliated with a public tertiary care center, is board certified in the specialty of Family Practice, and has a nurse practitioner in the office. There is only one physician in this practice,
serving approximately 38% Medicare patients and 6% Medicaid patients. The physician obtained his medical license in 1969. The employees in this practice appear to utilize the WWW technology. However, the physician utilized the WWW technology only one day, which may mean that his total utilization is attributed to training. The office manager clearly utilizes the e-mail technology more than the other employees do (Table 1). Advantages of the video and computer telemedicine technologies were mentioned fourteen times, including categories such as saving the patient from having to travel (mentioned 6 times), access to specialty care (mentioned 4 times), the convenience of follow-up care (mentioned once), educational opportunities for all staff (mentioned once), and access to information (mentioned twice). The only disadvantage mentioned in the interviews for the entire practice was by the physician regarding technical problems he had experienced. Barriers were spoken of twenty times. The most frequently listed barriers of the telemedicine technologies were ‘integration’ (referring to the technological fit within the organization) and ‘impersonal’ (referring to the lack of social intimacy). ‘Apprehension,’ or anxiety toward technological change was also a frequent barrier brought up by members of this practice. All respondents, except the physician responded that the video conferencing portion of telemedicine could provide the same quality of health care as face to face care. The physician expressed that the video conferencing could ‘sometimes’ provide the same quality of health care.

Practice Two is affiliated with a private tertiary care center, is board certified in the specialty of Family Practice, and has a nurse practitioner in the office. There is only one physician in this practice, serving approximately 10% Medicare patients and 30% Medicaid patients. The physician received her medical license in 1996. Only two employees of this practice are participating in the RTEP – the physician and the nurse practitioner. The physician appears to have low utilization, however, she has a second e-mail account through another Internet provider. Clearly, the nurse practitioner utilizes both the
e-mail and WWW components of the RTEP workstation. A variety of advantages were named by the physician in this practice regarding both the video and computer components of telemedicine. These included the access to specialty care, convenience of follow-up care, educational opportunities for all staff, the facilitation of communication, access to information, and the teleradiology services. Only three disadvantages of telemedicine were identified. The physician identified the technological problems she had experienced with the technologies, and the ‘slowness’ of the technology. The nurse practitioner expressed the disadvantage of the design of the keyboard, and how it was not suitable for the elderly. The most frequent identified barriers were ‘impersonal,’ referring to the lack of social intimacy the technology imposes, and ‘apprehension,’ referring to the anxiety toward technological change. The rural culture and the rate at which change occurs in that culture were also identified as barriers to the acceptance of the telemedicine technologies. Neither the nurse practitioner nor the physician expressed that the adoption of telemedicine would change their current role as a health care provider, except in the sense that it might make their job easier.

The physicians in Practice Three are in private practice, specializing in Internal Medicine. However, only one physician is participating in the RTEP. Nearly half of their patients are on Medicare, and approximately 15% of their patients are on Medicaid. The nurse practitioner in this office only works half time. The physicians both received their medical license in 1979. The office staff person utilizes the WWW technology, but does not appear to utilize the e-mail component of the RTEP workstation. The physician who was interviewed from this practice did not list any advantages to either telemedicine technology, but did list technological problems as a disadvantage. ‘Integration,’ or the technological fit within the organization was the most frequently identified barrier to the acceptance of telemedicine within the practice. ‘Impersonal’ was also identified as a barrier, along with ‘Disinclined’
(not interested), Referral (the existing referral patterns of the physician), no perceived need for the technology, scheduling, and training. The physician did express her belief that the same quality of care could come from using telemedicine as in face to face health care.

The physician in Practice Four is in private practice, not affiliated with any tertiary care center. He is board certified in Family Practice, received his medical license in 1983, and approximately 75% of his patients are on Medicare. The remaining patients are through Medicaid. He does not have a nurse practitioner through his office. All three RTEP participants from this office utilize the WWW technology, and none of them utilize the e-mail technology. The physician was the only employee in this practice that was interviewed. He acknowledged the educational opportunities for staff, both physicians, nurses, and administrative personnel as the only advantage to telemedicine. The main disadvantage identified was the lack of the ability to have ‘hands-on’ touch using the technology. ‘Integration’ (the technological fit within the organization) and ‘competency’ (lack of proficiency) were the two main barriers to acceptance of the technology mentioned by the physician, however he did feel that the same quality of care could come about through telemedicine as through face to face health care visits. He did not foresee any role changes as a health care provider as a result of utilizing telemedicine.

The physician in Practice Five is affiliated with a private tertiary care center, is board certified in Family Practice and received his medical license in 1971. Close to half of his patients are through Medicare and approximately 3% are through Medicaid. There is no nurse practitioner through this office. The office manager within this practice utilizes both the e-mail and WWW technologies more than the others, however, based on an interview with the physician, it was determined that he does use the WWW without going through the RTEP workstation. If the participant uses the WWW without going through the RTEP workstation, there is no way for the proxy server to track utilization. There
were no advantages to telemedicine identified by either the physician or the office manager (who use the RTEP workstation), however there were several advantages listed by the nurse and secretary. These were patient education, educational opportunities for staff, and the ability to communicate. ‘Lack of equipment’ and ‘security’ were identified as disadvantages. ‘Apprehension,’ (anxiety toward technological change) ‘competency,’ (lack of proficiency) and ‘time’ (a finite resource in which the participants have to learn and utilize the technology) were the most frequently identified barriers to the acceptance of telemedicine. Other barriers identified were ‘integration,’ (technological fit within the organization) ‘Impersonal,’ (lack of social intimacy) ‘learning,’ (refers to the understanding or awareness of the technological capabilities and limitations) and ‘responsibility’ (added responsibility). The office manager reflected ‘ownership,’ (there is an investment in the technology, to the point that they become stakeholders) and identified ‘prior experience’ (with computers) and ‘planning’ (of the implementation and training process of the technology) as the main facilitators to her acceptance of the technology.

Practice Six is affiliated with a public tertiary care center. The physician is board certified in Family Practice, does not have a nurse practitioner, approximately 80% of his practice are comprised of Medicare patients and 5% Medicaid, and he received his medical license in 1981. The office manager/nurse utilizes the WWW technology, but has very low e-mail utilization. The physician in this practice identified advantages of telemedicine in terms of saving travel for the patient and access to specialty care. The main disadvantage of the Internet technology was the accuracy of web-based information, but no disadvantage of the video conferencing was identified. However, the barriers to the acceptance of telemedicine were many. The most frequently cited barriers were ‘integration’ (the technological fit within the organization), ‘impersonal’ (lack of social intimacy), no perceived need for
the technology, and the rate of change in a rural culture. This physician does not use either the video
conferencing or the Internet components of telemedicine.

There are two physicians of Internal Medicine in Practice Seven. They are in private practice
and are not board certified, receiving their medical licenses in 1980. Approximately 60% of their
patients are through Medicare and 10% are through Medicaid. There is no nurse practitioner in this
office. Only one physician is participating in the RTEP project. The Secretary in the practice utilizes both
the e-mail and the WWW technology. Clearly the WWW technology is utilized more than the e-mail
component of the RTEP workstation. Educational opportunities for the staff was considered an
advantage of the telemedicine technologies for one of the physicians interviewed. The main disadvantage
for the video conferencing portion of telemedicine was the lack of the ability to have a hands-on touch.
He did not believe that his role as a health care provider would change as a result of telemedicine.

There is virtually no utilization of either e-mail or WWW technology in Practice Eight. This is a
private practice with one physician who is board certified in Family Practice, received her medical
license in 1994, does not have a nurse practitioner through her office, and close to half of her patients
are through Medicare, with another large portion of patients through Medicaid. Although the physician
in this practice has not utilized the video portion of telemedicine either, she did list educational
opportunities for the staff as an advantage to both the video and the computer-based telemedicine
services. She did not identify any disadvantages to the technology, but acknowledged ‘integration,’
‘impersonal,’ and ‘scheduling’ as barriers to the adoption of telemedicine. She responded that the same
quality of care could sometimes be achieved over telemedicine as in face-to-face health care.

The physician in Practice Nine is board certified in Family Practice, received his medical license
in 1968, and is not affiliated with any tertiary care center. Approximately 25% of his patients are
through Medicare and close to 10% are through Medicaid. There is no nurse practitioner through this office. Two of the employees in this practice are participants of the RTEP, the physician and an office staff person. Neither utilize the e-mail to any extent, however the office staff person utilizes the WWW component of the RTEP workstation. This physician did not allow for any interviews to be conducted.

There are multiple physicians in Practice 10, two are board certified in Family Practice, one physician is not board certified, specializing in General Surgery, and one physician is board certified in Infectious Diseases. Medical licenses were obtained in 1985, 1979, 1965, and 1988 respectively.

There is a nurse practitioner through this practice. Three of the four physicians utilize the WWW, however only one of them uses e-mail. The nurse practitioner uses both, as well as the administrator of the practice. The nurses and office staff do not use the e-mail, but a few have used the WWW. A wide variety of advantages were identified from the employees in Practice Ten. The most common were access to specialty care and saving the patient from having to travel to the tertiary care center. This is noteworthy because this practice is only 24 miles from the tertiary care center with which it is affiliated. Other advantages identified included: saving the physician from having to travel to the patient, convenience, educational opportunities, communication, the ability to see more patients, and teleradiology. Disadvantages identified were: the equipment is expensive, there is a lag time in the video conferencing component, there is a lack of ability to have a hands-on touch with the patients, the size of the video conferencing units is big and bulky, time, and technical problems associated with the use of the technology. ‘Integration’ (the technological fit within the organization) was listed 13 times as a barrier to the acceptance of telemedicine. This was closely followed by 11 responses of ‘time’ and 10 responses of ‘competency’ as notable barriers. Other barriers identified include: ‘access’ (referring to the ability to utilize the equipment or technology), apathy, apprehension, complex (perceived complex process),
communication, control (lack of influence the patient or physician would have over the telemedicine session), disincline (not interested in using the equipment), frustration with the system or process of using telemedicine, implementation (the delivery and set up of the technology), impersonal, no perceived need of the technology, the rate of change in a rural community, personnel (lack of available personnel to support the video technology), scheduling (the process of the planning of two or more parties to come together via telemedicine), and training (referring to the quantity and timing of the training where the purpose is developing a skill). There were nine responses of ‘yes’ when asked if telemedicine could provide the same quality of health care as face-to-face. No one answered ‘no,’ however there was one ‘sometimes’ and one ‘sufficient’ (meaning not really, but it is better than nothing) response. The majority of interviewees responded that they did not foresee telemedicine changing their role as a health care provider. Physician characteristics (referring to the personality and bedside manner of the telemedicine consultant to the patient) was identified as the most common facilitator to the acceptance of telemedicine. This clinic is currently involved in using telemedicine to conduct regular dermatological consults. The dermatologist visits the clinic through an outreach program once every two weeks. On the off week, he sees his patients over telemedicine. The physician has dynamic personal characteristics and a good working relationship with both the local physicians and his patients.

Discussion

Qualitative inquiry is a very useful method to discover phenomena that aids in the interpretation of meanings that participants ascribe to change (Greenhalgh and Taylor, 1997). However, as with any research method issues arose in our study that had the potential to limit the validity of the results. For example, one issue that arose throughout the interview process was that some interviewees may have provided us with answers that were socially desirable. While this bias in responses certainly can exist,
the openness with which participants discussed their perceptions of the introduction of telemedicine and
the guarantee of anonymity appeared to minimize this bias. Other potential limitations include the
reluctance on some providers part to grant an interview, problems with scheduling an interview, and the
interviewee not following through with the interview, especially physicians who were often detained by
patient care. Despite these latter limitations, sufficient information was gathered to allow for data
analysis. It is important, however, to recognize that these data represent the initial perceptions of the
health care providers as they begin to adjust to the new technologies.

Based on the practice descriptions and the coded interview data, several important findings can
be obtained. First, the results of our study show that practices can vary widely in their receptivity
towards the introduction of telemedicine. The utilization of telemedicine in the ten practices we studied
can be logically grouped into three categories: practices that are very receptive to the implanting
telemedicine, practices that are somewhat receptive for the growth of telemedicine, and practices that
are not receptive to telemedicine. For example, the following are two quotes from physicians who were
not receptive to telemedicine:

“We don’t wanna change. Everybody’s just fine the way it is...I’m not prepared for this.”

“Much like me with the computer. I don’t want to take the time to learn and the way I’ve always
done it is the best way and you know that’s pretty antiquated. I know I do it.”

While some physicians were not receptive to telemedicine, others welcomed it and readily saw the
potential capabilities that would enhance their practice. In most instances, these physicians had an established
affiliation with a tertiary care center where computer technology played a prominent role in the delivery of
patient care. The following are two quotes from physicians who were affiliated with a tertiary care center
and were receptive to telemedicine:
“...the computer - just get us hooked up to the University. What I’d like to do with the University-
I’d like to be able to find out people - like I’m not real familiar with a lot of doctors down there-
the doctors change a lot - the names and the departments...I need to know how to find e-mails on
some of the doctors who I’m going to use them. What I need is to be able to get stuff
out...because Medical records down there is slow. I need to be able to get into the medical
record. I don’t know what they’re going to do with confidentiality stuff, but I need to be able to
pull a chart up. I need to be able to pull records and stuff like that. If someone’s been at the
University - progress notes, whatever lab test - that kind of stuff. I need to be able to go to the
computer and pull it out. That’s what I need.”

“Hell, if the other guys (in the rural hospital) aren’t going to use it, just bring it down here and
let me use it. I could probably utilize it a heck of a lot better than they could. If they’re not
willing to...cause I’ve told them over and over, ‘See it’s really nice. It’s a convenience for the
patient.’”

Physicians who were somewhat receptive to telemedicine expressed ambivalence towards the
technology, yet were willing to accept it. The following are two quotes from physicians that illustrate this
ambivalence:

“I don’t use the computer a whole lot, so I kind of have a tendency to fight that one. You know,
you just have to get used to it.”

“Well, I really don’t like it because it’s not my type of thing, but I’m going to have to learn it”

Second, there was a clear difference between participants utilization of the e-mail component of
the RTEP workstation and the WWW component. This may reflect differences in issues of
communication versus information. One is used mainly for communication while the other is primarily an
information resource. For many rural physicians, particularly those in private practice, patterns of communication have been established over the years prior to the advent of e-mail technology. They know when and how, for example, to best communicate and consult with their colleagues (Greco and Eisenberg, 1993). The e-mail technology may be perceived by physicians as requiring considerable change to these patterns of communication and thus not worth the effort. As one physician said:

“Well first, it’s a new thing and it hasn’t been - we haven’t used it in our practice and it’s hard for us to get out of our old habits of how we do things. And so I think that’s to me a major thing.”

WWW technology, however, is strictly information gathering and may require less effort to change since it is less of an intrusion on established practice behaviors. As one physicians who has begun to integrate the web into his practice said:

“I see the benefits cause they’ve already used some of it by being able to get onto the Internet and getting information on drugs or different disease or disease processes...like if you had a patient come in that is being dismissed today and they’ve been put on a new drug, then (you) can pull up information about that drug and send it with the patient...or they’ve got a disease process that they want to learn more about, you can pull up a disease process on it and show them the information and give them some.”

Third, physicians may be more likely to use the RTEP workstation via ‘proxy’ than using the technology themselves. While physicians did not send e-mail messages frequently, if at all, they did occasionally receive some messages. In an interview with one of the physicians, he indicated that he had his wife/office manager check his e-mail and print out the messages. He would then tell her how to respond to the message and she would use her e-mail to carry out the order. This was due, in part, to
his inability to type, and in part, to his lack of knowledge regarding the technology. Similarly, one nurse practitioner in Practice Ten discussed in an interview that some of the physicians will ask her to go online for them to look up specific clinical issues rather than researching the issue themselves.

Due to the organizational culture and structure of a busy rural practice, it makes sense that the physician would have other staff members go online on his or her behalf. The physician’s main responsibility is to provide patient care to the best of their ability and the entire organization is generally set up to ‘support’ the physician. Therefore, it follows that the physician may perceive the computer as a tool the nurse or secretary can utilize for them. In this context, it is important to note that physicians who use a proxy are not rejecting the technology, but rather regard the use of the technology as an efficiency issue. As one physician said:

“I think I’m going to leave that up to my people. The only interest that I have is, uh, just to get some medical literature when I need some topic, that’s the only thing. But one of my people, she is into that, you know, in the computers. I’m sure she’s going to be wanting to learn it.”

Fourth, the three practices that had the highest e-mail and WWW utilization also had nurse practitioners in the office. Nurse practitioners may be seen as a physician’s ‘extender’ within the practice (Shurpin and Yanke, 1994; Matthews, 1993; Ferraro and Southerland, 1989). Similarly, Telemedicine has been regarded as a physician extender in the delivery of primary care (Benjamin, 1996; Harris, 1997). The physicians in these offices were open to using ‘extenders’ in their practices. Thus, a physician’s willingness to use an extender such as a nurse practitioner in their office increases their willingness to use telemedicine as an extension or tool within their practice.

Fifth, the practice characteristic of how many Medicare/Medicaid patients were seen in the practice did not appear to influence whether or not the physicians used the RTEP workstation. This
reflects the general distribution of the rural population in Missouri, which is older and has a high proportion of lower socio-economic populace (Mid-Missouri AHEC, 1997).

Based on our findings, it is possible to develop strategies of change that correspond to each of the three categories of practice. For each of these three conditions, strategies for change can be developed that enhance the potential for the growth of telemedicine in a rural practice as illustrated in Table 2 (Kanter, 1989; Beer, Eisenstat, and Spector, 1990; Kotter, 1995).

 Perhaps the single most important lesson to be learned from our study is that implementation strategies need to be tailored to the environmental conditions of the targeted health care agency. It is apparent that the selection of the targeted health care agency is critical to the potential growth of telemedicine. Clearly, focusing on those environmental contexts of the health care agencies that are most receptive to telemedicine allows for a greater potential for the benefits of telemedicine to be realized.
References


Mid-Missouri Area Health Education Center. Demographic Profile of 23 County Region. 1997;10-11.


Table 1: Utilization of computer-based telemedicine

<table>
<thead>
<tr>
<th>Practice</th>
<th>E-mail sent</th>
<th>E-mail received</th>
<th>WWW hits</th>
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<td></td>
<td></td>
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<tr>
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<td>0</td>
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<td>53 (same day)</td>
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<tr>
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<td>2</td>
<td>4</td>
<td>476</td>
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<td>224</td>
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<td></td>
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<td>NP</td>
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<td>87</td>
<td>234</td>
</tr>
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<td><strong>Practice 6</strong></td>
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<tr>
<td>Nurse</td>
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### Table 2: Strategies for Change

<table>
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<tr>
<th>Highly Receptive Identifiers</th>
<th>Partly Receptive Identifiers</th>
<th>Not receptive Identifiers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Affiliated with a public tertiary care center – access to public funds</td>
<td>Affiliated with a private tertiary care center – access to private funds</td>
<td>Private practice – limited funds</td>
</tr>
<tr>
<td>Support from parent institution</td>
<td>Contemplation of support from parent institution</td>
<td>Little support from physician – leadership</td>
</tr>
<tr>
<td>Uses extenders such as nurse practitioners</td>
<td>Some extenders</td>
<td>No extenders</td>
</tr>
<tr>
<td>Likely to have prior computer experience</td>
<td>Likely to have prior computer experience</td>
<td>No prior computer experience</td>
</tr>
<tr>
<td>Looks for ways to improve practice</td>
<td>Open to ideas to improve practice</td>
<td>No perceived need to improve practice – ulterior motive for technology</td>
</tr>
</tbody>
</table>

#### Strategies for change

**Highly Receptive Identifiers**
- Involve physicians and administration in planning and implementation process
- Team building within the practice
- Coalition building with affiliate physicians
- Empower the practice by providing space for the new technology, personnel, access, and training.

**Partly Receptive Identifiers**
- Establish a sense of urgency
- Team building within practice
- Coalition building within the community and specialty physicians
- Create a vision
- Communicate vision with the rest of the practice
- Empower employees to act on new vision
- Provide for short-term wins

**Not receptive Identifiers**
- Develop perceived need for technology (present physician with statistics on medical information overload, feedback on county’s medical information, etc.)
- Involve physicians in planning process
- Empower physicians to implement technology as negotiated – provide necessary resources
- Coalition building within the community and specialty physicians
Rural APN Telemedicine Utilization

Telemedicine Utilization
by Advanced Practice Nurses in Rural Missouri:
A Case Study

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Rural APN Telemedicine Utilization

Biography

Jane M. Armer, RN,C, PhD, is Associate Professor and Co-Director, Office of Research, at Sinclair School of Nursing, University of Missouri-Columbia. In related work, Dr. Armer has researched public perceptions of crisis in health care and receptivity to the advanced practice nurse role. In her own program of research, Dr. Armer has studied elders and adults of culturally diverse backgrounds during transitions, including relocation and management of chronic illness. Current research focuses on management of lymphedema in breast cancer survivors.

Information

Dr. Armer was an evaluation team member with the three-year National Library of Medicine-funded Rural Telemedicine Evaluation grant awarded to the University of Missouri-Columbia in 1996. In that role she collaborated with the project team in planning and implementing studies of telemedicine impact on nursing in rural communities.

OR

This work was conducted as a part of nursing studies carried out during the three-year National Library of Medicine-funded Rural Telemedicine Evaluation grant awarded to the University of Missouri-Columbia in 1996.

Acknowledgments

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recruitment, and data collection activities.
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Abstract

Telemedicine aims to increase access to health care through use of technology, but its impact on rural health care has been little-studied. Three rural counties of the 23 Missouri Telemedicine Network sites were chosen to pilot implementation of the computer as one mode of telemedicine technology to evaluate the impact of newly-implemented telemedicine systems on rural practice and patient care. Through National Library of Medicine-funding, the university provided telemedicine equipment and hook-ups to satellite clinics as well as non-affiliated clinics, nursing homes, hospitals and health departments in a three-county rural area. This research project focused on the use and impact of technology on the advanced practice nurse during the implementation of telemedicine in three rural telemedicine counties and three comparison counties. Qualitative research methods were used in eliciting data and developing a case study report of the experience of the rural nurse practitioner as related to utilization of telemedicine technology. Recommendations are made for future research and education.

Key Words

telemedicine  advanced practice nurse  rural  computers  technology
Abstract (long form)

Telemedicine aims to increase access to health care through use of technology, but its impact on rural health care has been little-studied. Three rural counties of the 23 Missouri Telemedicine Network sites were chosen to pilot implementation of the computer as one mode of telemedicine technology to evaluate the impact of newly-implemented telemedicine systems on rural practice and patient care. Through National Library of Medicine-funding, the university provided telemedicine equipment and hook-ups to satellite clinics as well as non-affiliated clinics, nursing homes, hospitals and health departments in a three-county rural area. This research project focused on the use and impact of technology on the advanced practice nurse during the implementation of telemedicine in three rural telemedicine counties and three comparison counties. Qualitative research methods were used in eliciting data and developing a case study report of the experience of the rural nurse practitioner as related to utilization of telemedicine technology. Although characteristics of respondents from telemedicine and non-telemedicine counties were similar, availability of technology differed. APNs in the telemedicine sites consistently identified current and potential applications of telemedicine technology to enhance communication, patient care, and professional satisfaction. Respondents in the telemedicine sites identified geographic and personal barriers in utilization of technology that diminished as the project progressed. The case study reports strong APN role satisfaction, productivity, and connectedness with colleagues and consultants, in large part due to the increased technological capabilities and training support provided by the telemedicine project in this rural county. Based on these findings, several recommendations are made for future research and education.
Rural APN Telemedicine Utilization

Telemedicine aims to increase access to health care through use of technology, but its impact on rural health care has been little-studied. This research project focused on the use and impact of technology on the advanced practice nurse during the implementation of telemedicine in three rural telemedicine counties and three comparison counties. Qualitative research methods were used in eliciting data and developing a case study report of the experience of the rural nurse practitioner as related to utilization of telemedicine technology.

Background

Advanced Practice Nurses and Rural Missouri

Some 140,000 advanced practice nurses (APNs) provide health care services in a variety of settings, rural and urban, in the United States (American Nurses Association, 1993). Some 3055 advanced practice nurses are registered with the Missouri State Board of Nursing, about one-fifth of whom (n = 605, 19.8%) practice in rural settings (Missouri State Board of Nursing, 1999). Over half of these APNs (n = 1572) are nurse practitioners (NPs), of whom almost one-third (n = 346, 29.9%) report they practice in rural Missouri counties. The state of Missouri is among the ten more rural states in the country, with some 1.3 million rural residents (Missouri Center for Health Statistics, 1984; Rural Primer, n.d.). In seventy of 114 counties, the largest community has less than 6,000 people, and in 49 counties, the largest community is under 3,000. In total, 71 of Missouri’s 114 counties (62.3%) are designated as primary care health professional shortage areas; 69 of those 71 (60.5%) are rural (Bureau of Primary Health Care, 1996; Federal Register, 1998). Because of its rural characteristics, Missouri provides a particularly appropriate setting for evaluation of telemedicine impact on health care.
practice in rural communities. The potential impact of telemedicine on advanced nursing practice in rural communities has been little-studied.

Nurse practitioners (NPs) as a group are mobile and subject to burn-out due to a multitude of factors, both personal and professional (Dunn, 1997; OTA, 1990; Stewart & Armer, under review; Strickland & Hanson, 1995). Recently educated advanced practice nurses practicing in rural communities may be particularly vulnerable due to factors such as geographical and sociocultural isolation. Lack of resources and equipment is cited by Schmidt, Brandt, and Norris (1995) as one of several barriers to rural APN practice in Kansas. Professional and personal factors often overshadow financial factors in APN decisions about practice sites (OTA, 1990). Telemedicine provides an alternative in health care delivery which potentially reduces professional isolation by increasing team development, cohesion, collaboration, and consultation. It provides an avenue of support for the geographically and socioculturally-isolated mid-range health professional and physician generalist.

Kuehn and Hardin (1999) found that nurse practitioner students were particularly receptive to using internet-capable laptop computers for documentation of student clinical experiences during participation in multidisciplinary rural health education projects in rural Missouri. Such computer training and experience during the educational experience lays a sound foundation for use of telemedicine technologies after graduation and might be perceived as a preventive intervention in reducing professional isolation in the rural workplace.

Telemedicine Definition and Impact

Telemedicine is defined as the concept of any health care provided to patients via technology
across a distance. Telemedicine can potentially break through some of the barriers such as time and distance currently encountered in accessing health care by using technology such as telephones, computers, and interactive video transmission (Remmes, Thompson, & Williams, 1996; Walker, 1997). Advanced communications technology can potentially remove geographic distance as a barrier to provider-patient interaction and information retrieval, thereby providing a more equitable health care distribution (Remmes, Thompson, & Williams, 1996). Such integrated telemedicine systems can potentially reduce rural practitioner burn-out and turn-over by providing a readily accessible means of communication and consultation with both fellow colleagues in similar rural communities and specialists in cooperating medical centers.

In 1996, based on their examination of the North Carolina Telemedicine Program, Remmes, Thompson and William presented nine points as justification for telemedicine reimbursement. Among these ways in which telemedicine supports improved patient care and increased provider satisfaction, and most pertinent to this review, is the position that telemedicine provides a mechanism for directly managing and supervising nurse practitioners, physician assistants, and other healthcare professionals in remote areas which significantly improves health care quality and can reduce professional isolation (Remmes, Thompson, & Williams, 1996, p. 1473).

Because the area of telemedicine effectiveness is little studied, the University of Missouri-Columbia was awarded a grant through National Library of Medicine (NLM) funds to evaluate rural telemedicine impact on health care. Three rural counties of the 23 Missouri Telemedicine Network sites were chosen to pilot implementation of the computer as one mode of telemedicine technology. Through
Rural APN Telemedicine Utilization

NLM funding, the university provided telemedicine equipment, hook-ups, training, and support to satellite clinics as well as non-affiliated clinics, nursing homes, hospitals and health departments in a three-county rural area of north-central Missouri. This pilot project has afforded the opportunity to evaluate the impact of newly-implemented telemedicine systems on rural practice and patient care.

In summary, telemedicine is an avenue by which a more equitable distribution of health care can occur (Forster, 1997; Remmes, Thompson, & Williams, 1996; Salzar, 1998). As health policy planners and providers continue to look at ways to improve access to healthcare in the twenty-first century, telemedicine technology is likely to become increasingly central to the goal of improved health care for all (Balch & Tichenor, 1997). Telemedicine opportunities have the potential to increase patient and provider satisfaction through removal of geographical distance as a barrier to provider/patient interactions and information retrieval. It is possible that advantages of rural telecommunication such as improved communication, professional networking and consultation, and opportunities for professional continuing education can mediate some of the perceived negative aspects of rural practice which contribute to APN burn-out and turn-over. However, the literature lacks evaluative studies focused specifically on measuring the effectiveness of telemedicine programs currently in place. This study aims to examine the influence of telemedicine on rural advanced practice nurses.

Research Focus and Overall Design

This particular research project focused on the experience of the rural advanced practice nurse during the implementation of telemedicine in three rural Missouri telemedicine counties and three comparison counties. Qualitative research methods were used to elicit data and develop a case study
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report of the experience of the rural nurse practitioner related to utilization of telemedicine technology.

The aim of the study was to evaluate use and impact of technology on the rural nurse practitioner in both north-central and southwest Missouri. One site, north-central, had access to telemedicine technology through the NLM-funded project, whereas the practitioners in southwest Missouri did not. The study sought to evaluate if rural practitioners’ job satisfaction was altered by access to telemedicine. The respondents were asked several questions regarding their degree of satisfaction in their current position; degree of perceived support from APN colleagues and collaborating physicians; and reasons they would/would not continue to practice in their current community position. Data on availability and utilization of current technology, including components of telemedicine, were elicited through a series of questions. The following section will discuss methodology (design, tool, interview process, and data analysis).

Methodology

Design

A qualitative approach with a semi-structured open-ended interview guide was used. Data collection was carried out through audio-taped individual face-to-face and telephone interviews.

Sample

The sample for this study consisted of APNs practicing in rural health sites in north-central and southwest Missouri. Selected key informants who were advanced practice nurses in one of the three rural north-central Missouri counties of the telemedicine network were identified and invited to participate in in-depth interviews. In a second wave of interviews, ten APNs who practiced in one of
two comparable counties in southwest Missouri but did not have access to telemedicine services were interviewed. In a third wave of data collection, five advanced practice nurses in a third southwestern Missouri county without telemedicine were surveyed.

**Tool and Sample Items**

Informants were invited to share their experience as rural practitioners through use of an open-ended semi-structured interview guide consisting of 20 questions with follow-up probes. The open-ended, exploratory questions were developed and piloted by the principal investigator. A specific focus of the open-ended questions dealt with availability and utilization of technology and perceived impact on practice and role satisfaction.

Sample items related to telemedicine and technology included:

- What telecommunications and computer technology is currently available in your workplace?
- How helpful do you currently find this technology in managing your work responsibilities?
- What barriers exist which keep you from fully utilizing the available technology?
- In what ways do you feel that technology could be helpful to you in the management of your responsibilities?
- What additional workplace changes would you like to see in the area of technology?

**Data Collection Procedure**

In the first wave of interviews, twenty advanced practice nurses (APNs) listed in a statewide database as practicing and/or residing in the University of Missouri telemedicine counties were invited to participate in interviews (Kuehn, 1998, unpublished APN data base). Nine APNs were interviewed
in the first year of the telemedicine project. Four APNs named in the data base had relocated at the
time of recruitment.

Additionally, in a second and third wave of data collection, fifteen advanced practice nurses
practicing in rural southwest Missouri non-telemedicine counties were interviewed and surveyed for
collection of comparison data. The practitioners and clinic sites in southwest Missouri had no affiliation
with a telemedicine project or the University of Missouri. In the second wave of interviews, the two
major hospitals in southwest Missouri were asked to provide a list of the nurse practitioners that they
employed in the surrounding rural counties. Twenty APNs from the lists were contacted initially;
fourteen agreed to be interviewed. Three of the original consenting participants canceled their interviews
due to scheduling conflicts and were unable to reschedule. In addition, one was terminated from her
position prior to the interview and did not leave a forwarding address for further contact. Therefore, ten
APNs in southwest Missouri were interviewed in the second wave. In a third wave of data collection,
five advanced practice nurses in another rural southwestern Missouri county (100% of the county’s
APNs) consented to complete the data collection tool in a pencil-and-paper survey format.

After initial contact by mailed postcard and telephone, the respondents were provided with a
letter of information and an overview of questions prior to the scheduled interview. Data collection in
the three telemedicine counties took place in face-to-face interviews. Due to scheduling conflicts and
participants’ preferences, three of the southwestern Missouri comparison interviews in Wave 2 took
place by telephone; the balance took place in face-to-face interviews. Additionally, five southern
Missouri APNs completed the data collection tool as a paper-and-pencil survey tool. Both face-to-face
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and telephone interviews were transcribed.

Data Analysis

General descriptive statistics including means and percentages were applied to summarize quantitative demographic data such as age and preparation. Management of the qualitative data was carried out by initially transcribing the tape-recorded interview tapes. The tapes were listened to a minimum of two times per interview. The transcribed interviews were then reviewed both individually and across individual questions for emerging themes. Thematic analysis of the qualitative data was conducted with the respondents’ complete thought as the unit of analysis. Data from five technology-related questions were summarized from the southwest Missouri interviews and reviewed for comparison with the summary data from the north-central Missouri respondents. Characteristics of the sample will first be discussed followed by findings related to the selected research questions. The profile of one rural advanced practice nurse in the telemedicine subsample will be presented in case study format.

Findings

Characteristics of respondents will first be summarized. The nine respondents interviewed from north-central Missouri in the first wave of interviews all practiced in rural sites that were affiliated with the University of Missouri’s Telemedicine Network Program. This sample consisted of one male and eight female masters-prepared nurse practitioners. All of these respondents had been in practice for less than three years (range = 4 months to 3 years, mean = 26 months). Four practiced in hospital-based rural clinics, three in hospital-based clinics, one in a private practice rural clinic, and one
practiced both in a rural county health department and a rural private practice clinic.

The characteristics of the ten southwestern Missouri respondents in the second wave of data collection were similar. Of the ten respondents, two were male and eight were female. They had all been in practice for less than five years and nine of the ten currently practiced in a rural setting. Eight of the southwestern Missouri APNs worked for regional health systems clinics in rural communities, and two were independent practitioners. All ten were masters-prepared family nurse practitioners with one being dually credentialed in geriatrics. The tenth interviewee originally practiced in one of the rural north-central counties, but had recently moved to one of the southwestern counties prior to being interviewed. At the time of the interview, she provided women’s health care in an urban clinic.

In a third wave of data collection, five advanced practice nurses were surveyed in a third rural southwestern Missouri county. Two of these APNs were diploma-prepared certified registered nurse anesthetists. Both were males and had been in practice about 10 years. The others, all three females, were family nurse practitioners (FNP) in rural practices. Of the three FNPs, one practiced in a rural health department and the other two in family practice settings. They had practiced from 3 to 5 years each. Two held master’s degrees in nursing. The third was a graduate of a diploma nurse practitioner program with a master’s degree in health services administration. The respondents ranged in age from 29 to 48 years (mean = 41.6 years).

In summary, the sample consisted of 24 advanced practice nurses from six rural Missouri counties. Nine were from three counties with telemedicine, while 15 practiced in three counties without telemedicine. The majority were female (19 versus 5); master’s prepared nurses (21 versus 3; 2 nurse
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anesthetists and one with a masters in another field held diplomas and were “grand-fathered” in advanced practice). Twenty-three practiced in rural sites: hospitals (n = 2), hospital-based clinics (n = 3), hospital-run rural clinics (n = 13), physician practices (n = 4), or county health departments (n = 2; one reported two work sites and one left her rural practice during the time line of the study).

Findings related to telemedicine

The selected findings which follow are related to technology utilization. They are organized by interview question.

*What telecommunications and computer technology is currently available in your workplace?*  Technological equipment and access varied broadly across respondents. In the telemedicine counties prior to the implementation of the NLM-funded telemedicine hardware and support resources, many had only telephones available for communication. Beyond the telephone, faxes were one of the more common technological capabilities for communication. For the most part, computers were not available to the NPs until after telemedicine implementation. Upon completion of the implementation phase, computers with internet access were available in all the cooperating sites, as well as centrally located hospital-based videotechnology capabilities in each county.

By comparison, several of the southwestern non-telemedicine respondents in Wave 2 had computers in the workplace, but no internet access in the office. One respondent reported her office now had internet access but her older model computer was not capable of using this resource. Telephones and fax machines were the commonly used technologies.

Among respondents in the third wave of interviews, all five respondents reported computers in
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the work setting, but only the nurse anesthetists had computers in their own offices. None had telemedicine access. Faxes commonly supplemented telephone communications.

APNs in the telemedicine sites consistently identified **current and potential applications of telemedicine technology** to enhance communication, patient care, and professional satisfaction. The following actual and projected utilization of telemedicine technology was reported by APNs in the telemedicine counties in north-central Missouri in the first wave of interviews.

**How helpful do you currently find this technology in managing your work responsibilities?** Current utilization of technology in telemedicine counties included: teleconferences with referred patients; X-ray telefax consultations; communication with physician specialists; family practice grand rounds teleconference; internet access to professional journals; patient education from internet sources; and standards of patient care from internet sources. Current utilization included activities for professional development (grand rounds video participation and journal access), improved standard-based patient care and up-to-date patient education, and communication with and patient referral to specialists.

**In what ways do you feel that technology could be helpful to you in the management of your responsibilities?** Potential utilization of technology in telemedicine counties included: teleconferences with referred patients; communication with physician specialists; internet access to research in professional journals; and internet access to facilitate nurse practitioner communication/collaboration. In addition to three of the seven uses identified as current utilization of technology, potential utilization included facilitation of nurse practitioner communication and
Those in the non-telemedicine southwestern counties perceived that increased availability of technology would increase their job satisfaction and patient satisfaction. They reported with increased technology they would be better organized, more up-to-date on the scientific literature, and, therefore, provide better services to patients.

**What barriers exist which keep you from fully utilizing the available technology?**

Respondents in the telemedicine sites identified geographic and personal barriers in the early phase of the project. In the early stages of the telemedicine project, as technology was installed, the NP’s access to the computer wired for the internet was hindered in one case by its placement in the physician-partner’s private office. (“If I go sit at the physician’s desk, if I use the physician’s personal computer, and take up her office....I have access to the Internet....There is no direct access for the NP.” [This barrier to access was corrected soon after the interview was completed.]) In other cases, initial installment was in an adjacent office or across town. NPs acknowledged their need for training and on-going support and encouragement in use of the telemedicine technology. (“I think just me knowing exactly how to do it and fast. I can’t do it fast so it seems like it takes a lot of time, so I just don’t do it.” “I haven’t used it nearly as well as I should...they have just started really to get us...into it. I think that if you would ask me this in a month, my answer would be different because we are just starting to use the Internet for patient education.”)

Among barriers to telemedicine technology utilization reported by those practicing in the non-telemedicine counties were: inadequate budget; inadequate time; inability to secure on-line
communication between the office and the hospital which owned the practice; and lack of a personal computer for use in the office for research and communication.

What additional workplace changes would you like to see in the area of technology?

Those in the non-telemedicine communities reported that they would like to have internet access. In some cases, this would require the addition of computers in the workplace; in another, it would require an updated computer. One APN without telemedicine access in her office responded, “The ideal setting would be able to log on at work (sic). Let’s say you have a particular problem...I mean you could just log on right there and get the immediate information...Consultations would be ideal. We work very closely with the cardiologist from (county), and, ideally if you had a question, instead of picking up the phone, you could just click in. ‘Dr. So-and-so, this is what I’ve got and what do you think?’ and then exchange that information with your peers on an immediate basis. That would be ideal.”

Some APNs in the telemedicine counties shared their visions of additional workplace changes that would enhance patient care, including patient-accessed work stations in the waiting room and work stations in every clinic room. (“Can I have (a) computer in the waiting room? You know that they (patients) can start accessing information themselves.” “I would like to see at each room that we would be able to access patient education right there. I would like us to be able to chart on the patient right when we are there...”)

In summary, although characteristics of respondents from telemedicine and non-telemedicine counties were similar, availability of technology differed between sites. APNs in the telemedicine sites
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consistently identified current and potential applications of telemedicine technology to enhance communication, patient care, and professional satisfaction. Respondents in the telemedicine sites identified geographic and personal barriers in utilization of technology that diminished as the project progressed. Respondents in the non-telemedicine sites identified five barriers to technology utilization, with finances prominent among them. They also identified aspects of telemedicine that they viewed as potentially beneficial to their practice.

Case Study

A case study of one rural nurse practitioner practicing in one of the three telemedicine counties further illuminates the impact of telemedicine on rural advanced practice and role satisfaction. This rural practitioner who shall be called “Libby” has been a nurse over 25 years, working “up through the ranks” as staff nurse, supervisor, and director of nursing of the local rural hospital. Because of the physician shortage in her rural county, five years ago Libby resigned and returned to school to earn her masters degree at the University in order to serve the rural population as a certified family nurse practitioner. Today she practices at a hospital clinic and a rural satellite clinic, is on the medical staff, has hospital admitting privileges, and certain clinical privileges such as ordering diagnostic work. In describing her decision to practice in this rural community, Libby stated, “My goal in going back to school was to be able to provide more services to the community, now episodic and chronic care to the people here. And since my roots are here, I just planned on staying here.” She spoke of planning to work here in the advanced practice role until she “retired as a nurse practitioner” in about 15 years. Support from the community, hospital administration, medical staff, and adequate financial
support all contributed to her decision to continue in her present position.

Libby listed ways she maintains connectedness with her colleagues and collaborators. She regularly attends the annual advanced practice meeting in the state capital. She maintains telephone contact with educational preceptors from her masters program. She uses e-mail to contact colleagues:

“I do have wonderful access right now to the internet, since this hospital does participate in the telemedicine grant; I am able to access a lot of health care people just through there and...have them answer my questions. So, I do have a lot of collegiate {sic} relationships even in the small rural hospital.”

Professional skills and knowledge are maintained and built through seminar attendance, and other telemedicine-based activities: “obtaining journals through the internet....telemedicine competencies, grand rounds at the University. I can watch family practice grand rounds...to keep up. Just sign up for the program and I go into a room and turn on the system, and am able to participate in an interactive seminar, so, yes, I do keep up with my skills.”

This rural family nurse practitioner has a high level of enthusiasm for the opportunities telemedicine provides in clinical practice. “That is wonderful that I have access to that (telemedicine). Just like I said, my LPN is looking up several of the issues that we discussed this morning from patients. The Nurse Practitioner, which is...a journal, I have that on the internet. I don’t really have to subscribe to this magazine. I have an address for it, and I can call that up, and find out an article that I want to look up and have access to the articles. It’s wonderful.”

Libby also finds the telemedicine technology extremely helpful with referrals to specialists. “For
instance with dermatology. ‘I don’t know what this is, can you wait just a minute and let me see if I can get a dermatologist to look at you?’ Well, the dermatologist is in Columbia, of course they are not physically here, but I can set up a telemedicine conference with the dermatologist. I can actually get the patient on the screen and the dermatologist can say, ‘Oh, yeah, that’s that and this is my recommendation for treatment.’ So, you know, having access to telemedicine is a tremendous factor in this small rural hospital.” She has found few barriers except the mechanics of scheduling appointments at a time that is mutually convenient for herself, the patient, and the dermatologist on call.

In response to the question about factors enhancing utilization of the available technology, Libby reported two factors: the affiliation with the University Hospital as an asset, as well as her follow-up with the referring physicians.

Very caught up in taking full advantage of the currently available technology, Libby had difficulty envisioning how technology could further assist in management of professional responsibilities. “You know, right now it is almost so overwhelming to, to know what I have right now that I’m not sure I can step over and see what the future is. Because it is just amazing what I have right now just in my office with telemedicine and the internet. And to almost look beyond that, I guess my mind just can’t quite go over there because I am trying to absorb everything that I do have available here....It’s like, ‘Wow!’...It’s like this is so great now that I am not sure I can identify what the future stuff...maybe next year I can...I am kind of in a honeymoon phase with this telemedicine and I feel very lucky to have that.”
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This respondent credits the training support of the project with her success in utilizing the technology. When asked about the most significant changes in technology she had experienced in her three years as a nurse practitioner, she replied, “Probably the (telemedicine) technology (itself). Being trained... it takes a lot of training someone such as me who did not have the skills, the computer skills, that you would need to enter information into the computer in order to store it or what can be retrieved out of it. So, along with just having the technology and equipment here, I have been provided with the training to use it. And so that is kind of where the mode is now with teaching how to interface with the University and get my referrals done and how to get the information, so I am still kind of in that phase and see that as an important phase for another six months to a year...”

Libby has been creative, generous, and empowering in her use of telemedicine with her patients in the clinic setting, sharing both her newly-learned skills and equipment. “Many times I ask questions, ‘Do you have access to the internet (for information on a condition such as throat cancer)?’ And they (patients and family members) say, ‘No.’ Well, I say, ‘Well, let me show you how to use a computer and you can set here and use mine while I am seeing other patients.’ Now, it would be nice to have that access for patients (in the waiting room). Maybe as people get more computer literate,...we may be able to help patients find information...themselves.”

The above-mentioned technological improvements might further increase this rural practitioner’s job satisfaction and productivity. “I think I will feel like I have given everything that I can possibly give to that patient....Maybe I wouldn’t have to spend all that time teaching,...doing it all myself.
I see a patient for 15 minutes, it takes me another 15 minutes probably to do my follow-up and my teaching....maybe at that point, that last 15 minutes can be supplemented ...with technology..” Libby suggests this increase in technology might boost her productivity. Seeing 300 patients a month, efficient use of time is an important issue.

In summary, clearly, this rural practitioner reports strong role satisfaction, productivity, and connectedness with colleagues and consultants, in large part due to the increased technological capabilities and training support provided by the telemedicine project in this rural county. This is a rural nurse practitioner who is energized by the telemedicine opportunities, one who is not experiencing frustration due to professional isolation and lack of resources, both risks for rural practitioners. Telemedicine resources provide a significant support for this rural practitioner.

Summary

In overall summary of findings, characteristics of the nurse practitioners from the rural telemedicine and non-telemedicine counties were similar in terms of gender, years in practice, and practice setting. Nineteen of the 24 respondents were female. As a group, they practiced in a variety of rural settings. With the exception of the two male nurse anesthetists and one with a non-nursing masters, all respondents were masters-prepared and all had practiced 5 years or less. Access to technology differed considerably among the two groups, with no APNs in the non-telemedicine counties reporting internet-linked computers. In contrast, the APNs in the telemedicine counties all had internet access on computers in their offices and nearby videoconferencing capabilities for professional education and referrals. Those with access to telemedicine reported both current and potential applications of
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technology to practice. Those without access viewed telemedicine as potentially supportive of patient care and professional satisfaction. Perceived barriers to technology among those without telemedicine were consistent with the literature, with financial concerns being prominent. Perceived barriers among telemedicine recipients were resolved early in the project through appropriate geographical placement of work stations and on-going training. In the case study example, the experience of one rural nurse practitioner recently introduced to telemedicine was summarized. Evidence was provided of the support for professional development and connectedness experienced through telemedicine, as well as increased satisfaction in meeting patient care needs in the rural clinic setting through use of technology for patient education.

**Discussion**

This preliminary study provides support for the role of a university-supported rural telemedicine network in supporting the nurse practitioner practicing in a variety of rural settings. Professional networking and connectedness were facilitated by telemedicine, as were professional development and patient education.

Mobility of nurse practitioners, identified in the literature as an issue, was verified with the finding that five of 20 NPs listed in the three-county APN data base (Kuehn, 1998) relocated before or during the Wave 1 interviews. This mobility adds to the difficulty of maintaining accurate statistics about the characteristics of the APN work force, as well as undermining continuity in care. Telemedicine can potentially influence turn-over rates for mid-range providers through increased support for rural practitioners.
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It is usual for new technological advancements to be greeted with enthusiasm by some and with suspicion by others. Among those who enthusiastically embrace innovations in technology, unrealistic expectations may initially cause some discordance. In the case of telemedicine technology, advances in specialist consultation at distance may be tempered with somewhat unrealistic expectations that the on-call specialist is immediately available 24-hours-a-day for even non-emergency consultations. A hint of this unrealistic expectation surfaced in the case study commentary about difficulty in scheduling a dermatology consult on short notice. It is unrealistic to expect that non-emergency telemedicine consults can be immediately activated. Obviously, the specialist on call may not be in an office or exam room next to the telemedicine equipment at that exact time. Telemedicine consultations in non-emergency situations are enhanced by prior scheduling; time and distance barriers are mediated with pre-planned videoconferencing appointments. Patients and physicians are saved time (travel time and waiting time) and distance traveled by these scheduled consultations. Further education and utilization of this telemedicine resource will gradually influence expectations to become more realistic.

**Recommendations**

Based on these findings, several recommendations are made for future research and education. Longitudinal assessment of telemedicine impact on rural advanced nursing practice is recommended to further increase understanding of implementation and continuity of telemedicine in rural communities. Qualitative data on the experience of telemedicine implementation in rural primary care practice can be supplemented by quantitative utilization data.

Introduction of telemedicine technology during graduate nursing and medical education is
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recommended. Such exposure during the training period has the potential to facilitate utilization due to increased familiarity, opportunity for increased computer skills, and exposure to the realm of possibilities in telemedicine utilization. Research to evaluate the effectiveness of inclusion of telemedicine experiences during the educational/training period should follow. Bringing rural primary care providers into contact with telemedicine early in their education and practice experience, combined with increasing their awareness of cost-benefit issues regarding telemedicine utilization and patient care, has the additional advantage of developing potential future advocates for implementation and expansion of telemedicine networks in rural areas.
References


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C-BAM Model and Telemedicine in a Rural Nursing Home

Application of the Concerns-Based Adaptation Model to the Adoption of Telemedicine in a Rural Missouri Nursing Home

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Information

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C-BAM Model and Telemedicine in a Rural Nursing Home

Abstract

The Concerns-Based Adoption Model (C-BAM) was developed in education for the purpose of implementing innovations and change within the school/college system. This study used the principles of the C-BAM and applied them to the process (implementation/training) and product (computer) of the telemedicine technologies in a rural nursing home setting in Missouri. Three rural counties of the 23 Missouri Telemedicine Network sites were chosen to pilot implementation of the computer as one mode of telemedicine technology. One rural nursing home was enlisted for an in-depth study to examine how telemedicine would affect communication between and among community health professionals. Methodological triangulation was used to study individuals’ concerns about and utilization of telemedicine through interviews, participant observations, chart reviews, and the Stages of Concern (SOC) survey. The participants consisted of nursing home employees: administration, nursing, housekeeping, and dietary. Forty-three of 52 employees participated in the Stages of Concern (SOC) survey at Time 1 (pre-implementation). Twelve months later, 40 participated in the SOC survey at Time 2. While the majority of respondents expressed awareness of the technology, they also expressed a high concern for informational and personal implications. Concern scores in all subscales decreased at Time 2. Findings from this study provided feedback for the implementation and training phases of the project.

Key Words

telemedicine nursing home rural computers change
Introduction

As people learn, they encounter and undergo change. Based on the Concerns-Based Adoption Model (C-BAM), people evolve in the questions they ask and their use of the change. C-BAM provides a framework for assessing technological concerns and insuring that learners' concerns are addressed. This study used the principles of the Concerns-Based Adoption Model developed in the educational setting and applied them in health care to the process (implementation/training) and product (computer) of the telemedicine technologies in a rural nursing home setting in Missouri. Three rural counties of the 23 Missouri Telemedicine Network sites were chosen to pilot implementation of the computer as one mode of telemedicine technology. One nursing home was enlisted for an in-depth study to examine how telemedicine would affect communication between and among community health professionals. A pre-post test design with data collection prior to telemedicine implementation and at 12 months post-implementation was used to compare technological concerns among workers at one rural telemedicine site over time. Stages of concern about technology were compared over time. Quantitative survey data were triangulated with qualitative interview data and observational data. Findings were applied in the implementation of the telemedicine project.

Background

Concerns-Based Adoption Model

The Concerns-Based Adoption Model (C-BAM) was originally developed in the educational realm for the purposes of implementing educational innovations and change within the school and college system. Innovation encompasses both process (e.g., team teaching) and product (e.g., a new reading
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text) changes (Hall & Loucks, 1978). The model has been used for the planning and delivery of staff-
development activities and mandated change.

As people learn, they undergo change. Based on the Concerns-Based Adoption Model, people evolve in the kinds of questions they ask and in their use of the change, from self-orientation to task-
orientation to impact concerns. The concerns model provides a framework for assessing concerns and insuring that learners' concerns are being addressed. The model suggests that time is a factor in the resolution of early concerns before later concerns emerge: implementation of new technology should be monitored over months and years.

This study uses the principles of the C-BAM model and applies them to the process (implementation and training) and product (telemedicine technologies) of the telemedicine technologies in a rural nursing home setting in Missouri. Methodological triangulation was used to study individuals' concerns about telemedicine through interviews, participant observations, chart reviews, and the Stages of Concern (SOC) survey.

Telemedicine

Telemedicine is defined as the concept of any health care provided to patients via technology across a distance. Telemedicine lessens the barriers of time and distance in accessing health care by using technology such as telephones, computers, and interactive video transmission (Balch & Tichenor, 1997; Bashshur, 1997; Forster, 1997; Remmes, Thompson, & Williams, 1996; Salzar, 1997; Walker, 1997). In Missouri, one of the ten more rural states in the country, 71 of 114 counties are designated as primary care health professional shortage areas (Rural Primer, n.d.). Telemedicine technologies offer the
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opportunity for specialist consultations and communications across distance, saving health professionals
and/or patients travel distance and time and further enhancing more equitable health care for rural
residents.

The University of Missouri-Columbia is a participant in the Missouri Telemedicine Network
(MTN), a video-conferencing network that extends to twenty-three sites throughout the state connected
by dedicated T1 lines. Three of the participating counties were chosen as pilot sites for the
implementation of another type of telemedicine technology - the computer. These three counties were
given computers stocked with the University of Missouri Internet Access Suite, Microsoft Outlook,
Microsoft Office, and a web-based workstation that was community-specific. A nursing home in one of
those three counties was willing to participate in an in-depth study to examine how the telemedicine
technologies, particularly the computer aspect, would affect communication between and among health
care professionals in the community. The nursing home did not have a video-conferencing system on the
grounds, although such a system was accessible through the local hospital. The nursing home was,
however, given computers at all of the nursing stations, in the conference room, and in the administrative
offices.

Methods of Procedure

Study Aims and Overall Design

Methodological triangulation was used to study individuals' concerns about technological changes
impacting rural nursing home communication. A pre-post test design with data collection prior to
telemedicine implementation and 12 months later (post-implementation) in the final 6 months of the
project was used to compare workers' technological concerns at one rural nursing home telemedicine site. Data collection included completion of paper-and-pencil Stages of Concern surveys; participant observation of nursing unit communication; chart review; and personal interviews. This research report focuses on Stages of Concern findings over time.

Sample

The participants in this study consisted of the employees at one nursing home in one of the three rural Missouri telemedicine counties. Physicians, administrative personnel, nurses, certified nurses assistants, certified medication technicians, housekeeping, and dietary personnel were included. Forty-three out of 52 employees, 22 of whom were nurses, participated in the Stages of Concern survey at Time 1. Face-to-face interviews were conducted with the 22 nurses. Forty employees participated in the second SOC survey conducted in the final 6 months of the project.

Data-gathering and Stages of Concern Questionnaire

The 35-item Stages of Concern Questionnaire (SOCQ) was developed to test the Concerns-Based Adoption Model. It measures the concerns individuals have toward a particular innovation such as telemedicine or computers (Bluhm & Kishner, 1988; Hall, George & Rutherford, 1979). The instrument is made up of seven factors relating to individuals' concern about technological innovations: awareness, informational, personal, management, consequences, collaboration, and refocusing. Widely used in education to assess teacher concerns about technology, it is useful in studying individuals' concerns about change. The SOCQ has reported raw score test-retest correlations ranging from .65 to .96 on the seven factors, with internal consistency coefficients ranging from .80 to .93 (Hall, George &
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Rutherford, as cited in Bluhm & Kishner, 1988).

Bailey and Palsha (1992) conducted psychometric testing of the 7-factor SOCQ with data from 146 individuals. Low reliability coefficients (<.70) were found for four of the seven subscales. Exploratory factor-analytic procedures were carried out, followed by scale revision, and subsequent reliability and correlational analyses for the newly derived 5-factor 15-item and 35 item scales. Use of the modified scale has not been widely reported in the literature.

There are several components of the C-BAM, one of which is a quantitative measure, the Stages of Concern Questionnaire, while the others are qualitative in nature. Individual interviews were conducted with nurses. Observations were gathered surrounding any type of nursing communications by phone, fax, beeper, or email. Chart reviews were also conducted on a regular basis, using the same log as the observations in order to get an accurate picture of the communication patterns as they existed before telemedicine was implemented, and the changes that have evolved as a result of the telemedicine technologies. Data collection included completion of paper-and-pencil surveys on Stages of Concern Questionnaire which were distributed and collected at the work site. Demographic data were also collected at Time 1. Respondents were asked to complete a second SOCQ survey approximately 12 months after implementation of telemedicine. The results of the two waves of the Stages of Concern survey are reported here.

Analysis

General descriptive statistics such as means and percentages were used to summarize the quantitative data. Directions for scoring were obtained from the Planet Innovations at the University of
Missouri-Columbia who work with the web-based version of the tool. Stages of Change subscale scores were calculated and compared at Times 1 and 2 in the form of bar graphs. This is consistent with Bluhm and Kishner’s (1988) and Hall, George, and Rutherford’s (1979) recommendations on handling of the data: they suggest graphic analysis of trends and patterns in the data, including examination of data over time.

Because of Bailey and Palsha’s (1992) psychometric findings, face validity concerns, and sensitivity to this first application of the C-BAM and SOCQ outside the realm of education and in the field of health and telemedicine, each item, its fellow items, and its corresponding factor were carefully reviewed by the telemedicine team including the biostatistician. After an initial analysis of Time 1 data incorporating all 35 items and their relevant factors (Figure 1) and a 2-week re-test on eight participants (Figure 2), decisions were made to modify the factors for the pre-post (Times 1 and 2) analysis. These decisions were largely made based on face validity, as sample size was not sufficient for further factor analytic procedures. The seven original factors were retained and an eighth single-item factor was identified that appeared to stand-alone (Table 1). Comparisons of the factor subscale scores are seen in Figure 3.

No inferential statistics or factor analysis were carried out due to limitations related to sample size. Dependent t-test was not used to compare Time 1 and Time 2 data because of coding decisions made to address administrative and employee concerns about confidentiality, nor were individual SOCQ scores compared with individual telemedicine utilization patterns, for similar human subjects concerns.
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Findings

Time 1 Respondent Characteristics

Forty-three of fifty-two LochHaven employees responded to the Time 1 survey. Thirty-seven reported they were in the nursing department; twenty-two were nurses. Fifty-one percent (22 of 43) reported they had a computer at their prior workplace. Nineteen percent (8 of 43) had previous internet access at work. Thirty-three percent (14 of 43) had a computer at home. Nineteen percent (8 of 43) reported home internet access.

Time 1 Stages of Concern data revealed staff were focused on informational and personal implications of technological innovations (Figure 1). Awareness concerns were also dominant at this time. Findings at the 2-week retest were consistent with those at Time 1 (Figure 2).

Upon comparing the newly derived subscale scores at Time 1 and Time 2, all scores decreased at Time 2. This would suggest individuals’ concerns decreased over the 12 months of the implementation of the project, a finding in the expected direction if the program is progressing smoothly. In all cases, lower scores are a good@n terms of levels of concern. In keeping with the concept of moving through stages from awareness to informational and personal concerns, on to management, collaboration, and consequences concerns, one would anticipate a profile with gradually increasing concerns about management, collaboration, and consequences as individuals moved through the stages of concern about telemedicine technology. The difficulty with only two snapshots in time is that changes in concern may have occurred and resolved. This would lend support to an approach of more frequent data collection points to better understand the meaning of the trends that are captured.
Findings from the 35-item Stages of Concern instrument (seven factors relating to individuals = concerns about technological innovations: awareness, informational, personal, management, consequences, collaborating, and refocusing) were compared to findings from open-ended interviews with nursing home staff and advanced practice nurses. Those with higher education voiced greater understanding of potential applications of technology in the practice of nursing. For example, those staff nurses in the nursing home were accepting of and interested in the transition to computerization, but not as vocal in suggesting additional ways the technology could be used for patient education, standards of care, and staff and professional education as were nursing administration in the nursing home and advanced practice nurses in the community, both the more highly educated respondents interviewed. These last two groups of respondents viewed the technological change as empowering for self, staff, and patients and families.

**Preliminary Findings**

**Mean Subscale Scores at Time 1**
Mean Subscale Scores at Time 2 (N=8)

<table>
<thead>
<tr>
<th>Subscale</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Awareness</td>
<td>15</td>
</tr>
<tr>
<td>Inform</td>
<td>14</td>
</tr>
<tr>
<td>Management</td>
<td>13</td>
</tr>
<tr>
<td>Competency</td>
<td>12</td>
</tr>
<tr>
<td>Collaboration</td>
<td>11</td>
</tr>
<tr>
<td>Awareness</td>
<td>10</td>
</tr>
<tr>
<td>Inform</td>
<td>9</td>
</tr>
<tr>
<td>Management</td>
<td>8</td>
</tr>
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<td>Competency</td>
<td>7</td>
</tr>
<tr>
<td>Collaboration</td>
<td>5</td>
</tr>
</tbody>
</table>
Summary and Conclusions

Although the C-BAM (Concerns-Based Adoption Model) was developed in education for the purposes of implementing innovations and change within the school and college system, the model has now been applied to implementation of technology in the health care setting. This study used the principles of the C-BAM as a framework for assessing technological concerns in a rural health setting and applied them to the process (implementation/training) and product (computer) of the telemedicine technologies in a rural nursing home in Missouri. Three rural counties of the 23 Missouri Telemedicine Network sites were chosen to pilot implementation of the computer as one mode of telemedicine technology. One nursing home was enlisted for an in-depth study to examine how telemedicine would...
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affect communication between and among community health professionals. The participants consisted of employees at a rural nursing home. Administrative personnel, nurses, CNAs, CMTs, housekeeping, and dietary personnel were included. Methodological triangulation was used to study individuals’ concerns about telemedicine through interviews, participant observations, chart reviews, and the Stages of Concern (SOC) survey. Forty-three of 52 employees (22 nurses) participated in the SOC survey at Time 1 (pre-implementation). Forty participated in the SOC survey at Time 2 some 12 months later. Interviews were also conducted with 22 nurses.

While the majority of respondents expressed awareness of the technology, they also expressed a high concern for informational and personal implications. Findings from this study provided feedback for the implementation and training phases of the telemedicine project. For example, training was continued on the nursing units after the initial individual and small group training session in an administrative conference room during implementation. It was found that technical assistance on the nursing units during the initial stages of using the telemedicine technology (largely electronic mail and internet searches) built confidence and facilitated utilization. Project staff/data collectors who were regularly on the units throughout the implementation and training phases were often available to offer one-on-one assistance and consultation in the early stages of the project. This reciprocal interaction likely created good will that in turn enhanced site support for compliance with the research data collection.

Discussion and Recommendations

While not unexpected, another lesson learned from this project was the on-going nature of the implementation phase. While project time lines were carefully mapped out and adjusted as necessary,
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implementation was not complete at a discrete time point, but rather was on-going due to need for continuing support and training and work site (in this case, nursing home) employee hiring and turnover. Thus, the second data collection, originally planned for 6 months post-implementation, was modified to be carried out in the final 6 months of the project, approximately 12 months after the Time 1 data collection. This change is highly consistent with the underlying principles of the C-BAM model, in which it is recognized that people and their concerns evolve over time. Future data collections at even later dates, such as 24 months after implementation, would be appropriate and increase our understanding of individual concerns about telemedicine technology in a rural nursing home over time.

Further exploratory factor analysis of the SOCQ with a larger data set from the health care field would add insight into possible similarities and differences between C-BAM and SOCQ applications in education and health. The greatest value for the SOCQ is as a tool which provided feedback about individuals’ responses to and concerns about innovation. As such, the C-BAM has considerable potential in the health field, particularly in telemedicine and distance learning, both of which rely heavily on innovations in technology.
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References


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Stages of Concern Factors and Sample Items

Awareness Concerns

I am not concerned about it.

Informational Concerns

I would like to know more about it.

Personal Concerns

How will using it affect me?

Management Concerns

I seem to be spending all my time getting materials ready.

Consequences Concerns

How is my use affecting patients? How can I refine it to have more impact?

Collaboration Concerns

How can I relate what I am doing to what others are doing?

Refocusing Concerns

I have some ideas about something that would work even better.