NLM Final Technical Report
Contract # NO1-LM-3540

Submitted by

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Section 1: Executive Summary

NLM Contract # NO1-LM-6-3540 (1996 – 2001) was initially a three-year contract with the Applied Sciences Laboratory of the University of Alaska Anchorage to test and evaluate the use of narrow bandwidth telemedicine applications and technologies in frontier Alaska. Awarded in 1996, this contract was extended for one year as a "no cost contract extension" and for one year as a cost extension.

The Alaska Telemedicine Testbed Project was a partnership between the National Library of Medicine and the Applied Science Laboratory of the University of Alaska Anchorage. Using a "partnership model" that placed great responsibility on subcontractors, the Alaska Native Health Board was chosen as the principle subcontractor to the University of Alaska Anchorage. Following this, four Alaska Native Health Corporations, of a total of 12 Alaska Native Health Corporation, were chosen to participate in the project.

1996 Indian Health Services data was used as a baseline for clinical activities. Upon analysis of this baseline data, ENT was chosen as the focus of the study because of the severity of ottis media in rural Alaska.

Based on technical meetings that included representatives from Alaska Native Health Corporations, an Alaska Telemedicine Workstation (ATW) was developed that was designed to work in community health clinics that are typically under 600 square feet and have power reliability problems. Based on partnership meetings, the ATW was developed around a computer designed as a "communications server." An AMD video otoscope was chosen as the clinical tool best suited for ENT work in rural clinics. In addition, an initial bandwidth throughput analysis conducted in 1997 revealed that the average throughput to the village clinic was 900 baud. By 2000, bandwidth throughput had increased to 1,900 baud in all villages. In late 2000, Region One villages were connected to a Wide Area Network (WAN) at 56 kbps.

An Alaska Telehealth System software package was developed and designed to "take advantage" of Alaska's narrow bandwidth telecommunications environment. The software packages were developed to allow Alaska Community Health Aids to create an ENT case, record a digital image of the outer and inner ear, and send this data to the regional hospital for consultation with the primary care physician and, if necessary, to the Alaska Native Medical Center in Anchorage.

For purposes of this study, a total of 38 workstations were deployed in rural Alaska. Informed consent forms were developed. Training and support programs were developed to support operations. Village Community Health Aids were instructed to record all ENT cases and to use the system for any additional purposes that seemed appropriate. Because of the remoteness of these clinics, data verification was extremely difficult. According to final records, more than 6,600 clinical cases were recorded throughout the project. Additional dermatology and emergency medicine cases were recorded but "un-captured."

Following development and deployment of the Alaska Telehealth Workstations, three major hypotheses were proved:

1. the ATW system was perceived by patients and providers as being "as good or better than traditional methods of healthcare delivery in rural Alaska (see Appendix 3, pp. 27-30);
2. using data baselines established for provisioned services in rural Alaska, there was evidence of a perceived benefit of the ATW system (see Appendix 9, pp. 200-230)

Additionally, one hypothesis was generated from preliminary data and proved interesting:

3. the existence and use of an ATW system decreased the use of antibiotics for ENT during the project (see Appendix 9, pp. 150-180)

In addition, two major hypotheses were deemed either to have been naïve or false:

1. the availability of advanced telemedicine services did not increase the length of stay by healthcare professionals in rural Alaska (see Appendix 9, pp. 180 – 210)
2. the availability of advanced telemedicine services only marginally changed transportation patterns of healthcare delivery in rural Alaska, thereby providing the "business case" funding for "re-engineering" healthcare delivery in rural Alaska.

The Alaska Telemedicine Testbed Program was a unique and difficult project because of the geography, remoteness, topology, and political landscape of Alaska. While distance and remoteness are relatively easy to understand (although often discounted by non-Alaskans), the independent nature of villages and regional Native Health Corporations, and the politics of healthcare delivery in Alaska, made this project especially daunting.

Nonetheless, the Alaska Telemedicine Testbed Project should be viewed as a qualified success. Advances in telecommunications services, and increasing affordability as the result of the Universal Service Fund, are changing the telecommunications infrastructure of rural Alaska. However, the legacy of the Alaska Telemedicine Testbed Project is that it proved the concept of using "advanced telecommunications services" to improve the delivery of healthcare in rural Alaska. More important, the project proved that with the proper tools, proper training and proper support, telecommunications and information technology can improve the delivery of healthcare in remote environments.

Section 2: Background

Overview of healthcare delivery in Alaska: 1994-1996

In 1994 Commonwealth North, a private organization, which conducts research about Alaska's public policy issues, published "Alaska Health Care in Crisis." This document argued that Alaska's geography, demography, and ethnography had created a health system that was fragmented and a system in "crisis." The document pointed out that there are actually three health systems in Alaska: private health care organizations like Providence Health Systems in Alaska, Bartlett Memorial Hospital, and Fairbanks Memorial Hospital; military health care organizations like the Third Medical Group at Elmendorf Air Force Base; and Native health care organizations like the Alaska Native Medical Center and regional Native health care organizations like the Southcentral Foundation and the Bristol Bay Health Corporation. While pointing out the obvious, that each of these systems was not integrated with the others for maximizing the efficiency of health care delivery in Alaska, the document was published without any references to telecommunications, information technology, telemedicine, or telehealth. The authors of the Commonwealth North report did not foresee the transforming characteristics of sustainable telemedicine and telehealth applications and technologies.

The authors of the Commonwealth North document noted that health care delivery in the Alaska "railbelt" resembles that of most suburban United States. The Juneau-Anchorage-Fairbanks corridor contains nearly 80% of Alaska's 615,000 people. Though sparsely populated by "lower-48 standards, this corridor is actually Alaska's main transportation and "information corridor" that contains microware repeaters and newly installed fiber optic cabling. Here are small hospitals and clinics that resemble those in western states. However, health care in native villages is based on Community Health Aides, village members who act as primary care givers, and village-to-regional center-to-Anchorage transportation-based model of health care delivery.

In Alaska there are three healthcare systems often cooperating; often-in competition. The private sector, Indian Health Services, and Military health facilities serve a population of 615,320 people.

While Alaska is a geographically large state, with a relatively small population and low population density, Anchorage is the healthcare center of the state. Anchorage has four modern tertiary hospitals, Providence Alaska Medical Center and Alaska Regional Hospital, the new 3rd Medical Center at Ft. Elmendorf, and the new Alaska Native Medical Center.

While the three healthcare systems in Alaska theoretically cover three distinct groups of individuals, any number of individuals are potentially clients for each service. For instance, with nearly 25% of Alaskans either current or retired military, many Alaska Natives are "covered" by three healthcare systems. It is not unusual for an Alaska Native to be a veteran, have third party medical insurance (Blue Cross/Blue Shield) and be "covered" as a Alaska Native. And, while it is the case than a statistically significant

proportion of Alaska Native people living in rural Alaska do not have convenient access to other services in Anchorage, it is not uncommon to see Alaska Native people seeking healthcare at private sector facilities in Anchorage.

While the demographics of rural Alaska necessitate that Native Health Corporation facilities, former IHS facilities now owned and operated by regional Native Corporations, the opportunities presented by the use of telecommunications and information technologies, telemedicine and telehealth, have not changed the competitive nature of healthcare delivery in Alaska. In principle, the development of telehealth services should mean that Alaska Natives, and all Alaskans, should be able to choose their healthcare services electronically. And, while this vision of individual choice is still a technical impossibility, current systemic operations will continue to be an impediment to the implementation of telehealth systems and services that might achieve economies of scale for advanced services "where and when people need them."

Currently, the development of the Alaska Federal Healthcare Partnership, and the development of the Alaska Federal Healthcare Access Network have developed a "private network" to "recapture" Native healthcare services," thereby precluding interaction of service delivery. Alaska's three healthcare systems remain stovepipes.

Telemedicine Initiatives in Alaska: legacy of telemedicine technical and infrastructure projects

Many attempts have been made to demonstrate the use of telecommunications technology to improve the healthcare of isolated Alaskans. While a number of these early projects might have been judged to be a success, these projects did not have any lasting influence of the development of telehealth in Alaska. These projects have included:

- 1971-1976: ATS 1 and ATS 6 demonstration projects which used "state-of-the-art" NASA satellites to provide single side band radio communication and the early video communication from healthcare facilities in Anchorage and the "lowe-48" to remote villages in the Alaska interior
- 1989-1992 North Slope Borough "slow scan video" project which used "state-of-art" low resolution video to deliver early video conferencing-based healthcare services to Barrow and from Barrow to North Slope villages
- 1993-1995 University of Washington Telemedicine Project demonstrated limited video teleconferencing-based healthcare delivery to five clinics in five states including Petersburg, Alaska
- 1994-6 Copper Valley video project which was intended to provide videoconferencing-based telehealth and distance education from Glenallen and Valdez to the villages of the Copper River
- 1995-1997 Bartlett Regional Medical Center video conferencing project was intended to provide videoconferencing-based telehealth and

continuing medical education services from Virginia mason Hospital in Seattle to Juneau

- 1995-1998 North Slope Borough NTIA project was designed to provide "high speed" videoconferencing-based healthcare delivery to the eleven villages of the North Slope Borough
- ATP/PHSA teleradiology project was designed to use narrow bandwidth (56 kbps) to establish radiology network from Providence Alaska Medical Center in Anchorage to Seward, Kodiak, Valdez, Dutch Harbor, Homer, Talkeetna, Girdwood.
- Yukon Flats Telehealth Project was designed to provide "high speed" videoconferencing-based healthcare delivery to the villages of the upper-Yukon River
- Yukon-Kuskokwim Health Corporation USDA and NTIA projects were designed to provide videoconferencing-based healthcare delivery to the 55 villages of the Yukon-Kuskokwim delta from Bethel

Alaska Telemedicine Testbed Project: 38 small communities in a large state

The Alaska Telemedicine Testbed Project (ATTP) used narrow bandwidth "store and forward" technology to deploy telemedicine workstations in 38 villages and towns in Alaska (see Appendix 1, pp. 1.10 – 1.13). Designed as an evaluation project (see Appendix 1, pp. 1.14 – 1.20), ATTP focused on discovering how to use current technology and telecommunications infrastructure to improve the delivery of health to rural Alaska (see Appendix 3, pp. 3.1 – 3.16). Based on a simple research question, ATTP was interested in finding out which rural health clinics could successfully use the public switched network with throughputs ranging from .9 kbps to 56 kbps. The primary objectives of ATTP were to discover if telemedicine workstations could be deployed; if protocols could be developed for ENT; if digital images could be transmitted at .9kbps and "read" at rural healthcare "hubs," if patients and provides believed that this type of healthcare service was "as good or better" than "transportation-based models" of healthcare delivery; if training and support models could be developed; and if a benefits and cost model could be developed to justify the use of telemedicine as part of a business model for healthcare organizations in rural Alaska.

The Alaska Telemedicine Testbed Project successfully deployed to 38 small communities in Alaska and demonstrated that narrow bandwidth telemedicine for ENT, dermatology, and emergency medicine could work.

Section 3: Pre-funding activities: The Alaska Telemedicine Project 1994 – 1996

Alaska Telemedicine Testbed Goals

The Alaska Telemedicine Testbed Project proposal was based on the activities of the partners of the Alaska Telemedicine Project, 1994 - 1996.

Beginning in September 1994, the Alaska Telemedicine Project (ATP) partners, including the Applied Science Laboratory of the University of Alaska Anchorage, Providence Health Systems in Alaska, Alascom, Inc. (now AT&T Alascom) and various Native Health Corporations, both advocated and advanced the use of telemedicine in Alaska through "mini" demonstration projects. Members of ATP, whose membership grew to 53 members, believed that a "loose consortium" of interested parties should begin to investigate how to use telecommunications and information technologies to improve the delivery of healthcare in rural Alaska.

From 1994 to 1996, Alaska Telemedicine Project partners developed strategies for implementation in Alaska. While using the University of Alaska Video Conferencing Network for quarterly meetings demonstrated the ability to use video conferencing between Juneau-Anchorage-Fairbanks, projects partners made a conscious decision to develop other strategies and technologies that would include "frontier Alaska." While "store and forward" was a term yet to be coined, members of the Alaska Telemedicine Project began a needs assessment process that indicated that "urban" health care providers in Anchorage "did not need" nor "did not want" "live" video. Emergency room physicians and primary care providers stated forcefully that they wanted "reliable patient information," email, and high-resolution images.

The Alaska Telehealth System model

In 1994, the Alaska Telemedicine Project website was established as a repository of documents about "health care in the digital age." Beginning in 1995, the Alaska Telehealth System was prototyped and deployed as a core messaging system (see Appendix 8, pp. 8.1 – 8.13). This "client-server" messaging system was initially "powered" for FirstClass 2.1. In 1996, a highly customized version of FirstClass 2.7 integrated web site information and links with a core messaging system that allowed users in frontier Alaska to dial-in directly to the server located at the Applied Science Laboratory of the University of Alaska Anchorage. The Alaska telehealth System v.1 was made freely available to all Alaska health care providers. This system provided users with internet email, core messaging, conferencing, health care information, listservs, newsgroups, on-line chat, and the ability to upload and download digital images. ATS v.2; v.3; v.4; and v.5 included customized health care forms, additional image "readers" including DICOM, ODBC connectivity, and complete integration to the world wide web. This allowed "urban" and frontier users to experience the same features of the system mitigated solely by the connectivity to their desktop.

ATP directly supported projects designed to test the feasibility of using telecommunications and information technologies to serve rural Alaska from Alaska's healthcare hub, Anchorage. Beginning in 1994, these projects included support for developing an open software system based on Alaska's public switched network. The Alaska Telehealth System v. 2 (ATS) was supported by Providence Health Systems in Alaska (PHSA) and was used to demonstrate telemedicine applications from Anchorage to Seward, Kodiak, Cold Bay, Valdez. Supported by PHSA and Alascom, ATS was

designed as a secure client/server communications system and designed to be freely distributed to ATP partners and supported by the Applied Science Laboratory at the University of Alaska Anchorage.

In addition, ATP partners helped develop and support PHSA 56 kbps teleradiology project that extended radiology services from Anchorage to Seward, Kodiak, Homer, Valdez, Talkeetna, and other rural sites. Other projects included support for a North Slope Borough slow-scan video conferencing project; Norton Sound Health Corporation community health aid information network (CHAIN), as well as regional initiatives in Juneau, Fairbanks, and Bethel.

During this time, ATP preformed initial feasibility studies feasibility studies regarding the utility of telemedicine applications and technologies modified to work in Alaska's demanding narrow bandwidth telecommunication environment. An initial bandwidth study in 1995 indicated that 80% of Alaskan villages were without internet service using standard dial-up technology and, where available, average throughput to the desktop in the village clinics was 900 baud.

The three major contributions of the University of Alaska Anchorage to the Alaska Telemedicine Project were: 1) the development of a working group of healthcare, telecommunications, and information technology professionals to discuss and plan for the implementation of telemedicine systems in Alaska. A principle feature of the ATP workgroups were to "open discussion" among professionals for all major healthcare organizations throughout Alaska; 2) the development of the Alaska Telehealth System (ATS) funded by Providence Health Systems of Alaska. This secure client-server system was designed to serve as a management and clinical decision support system and designed to work at 1200 baud with dial-up technologies. ATS v. 1 was introduced to Alaska and made "freely available to all bona fide healthcare professionals in Alaska; and 3) the development of an "evaluation matrix" designed to capture change as the result of the introduction of telemedicine applications and technologies. This evaluation, which initially included five components: cluster analysis, satisfaction analysis, survival analysis, cost and benefit analysis, and utilization review, was embraced and justified given the history of "program reviews" of technology projects in Alaska. This evaluation was based on a review of "failed projects" that had been "sweep under the rug." This included the successful ATS 1 and ATS 6 projects in the early and mid 1970s, the North Slope Borough "slow scan tele-video project," and the Bartlett Regional Hospital tele-video project.

From September 1994 until May 1996, members of the Alaska Telemedicine Project had weekly planning meetings and initiated four "mini-demonstration projects" designed to "make the case" for the implementation of a "sensible telemedicine system in Alaska" that was open to all healthcare organizations. Project partners submitted six proposals and were granted two TIIAP grants for telemedicine demonstration projects. Sixteen major presentations were made to justify member activities and to build a "loose consortium."

Alaska Telemedicine Project evaluation model

First and foremost, the principle goal of the Alaska Telemedicine Project (ATP) was not repeat the mistakes of the past. With this in mind, ATP began with the following assumptions: 1) that narrow bandwidth applications and technologies might have viability in an environment in which broad bandwidth is either not available or too costly to be practical and 2) that an evaluation model was needed to ensure that any demonstrations of telemedicine applications and technologies would capture successes and failures.

ATP evaluation model was designed around six distinct features:

- a cluster analysis to determine the willingness and readiness of remote villages to implement telemedicine applications and technologies
- a "satisfaction study" designed to determine whether patients and providers perceived telemedicine applications and technologies as being "as good or better" than current treatment models based on transportation
- a benefits study designed to determine if patients and providers perceived a "benefit" of telemedicine applications and technologies
- a "survival study" to determine if "advanced telecommunications and information technology services would, in any way, change the length of stay of healthcare professionals in rural Alaska
- a "cost study" to determine the "cost per transaction" of each telemedicine encounter during the project. The cost threshold was determined to be "less than HICFA reimbursement" for ENT
- a utilization study designed to determine if telemedicine services were bring about a positive health outcome.

While the cluster analysis and utilization analysis were not used in the Alaska Telemedicine Testbed Project, ATP partners believed that these seven evaluation models, taken together, would capture any changes in the delivery of heathcare services to rural Alaska.

Section 4: Overview of the Alaska Telemedicine Testbed Project

The National Library of Medicine "Alaska Telemedicine Testbed Project" proposal was a direct extension of the Alaska Telemedicine Project. Indeed, the proposal submitted by the Applied Science Laboratory was "...on behalf of the members of the Alaska Telemedicine Project."

Based loosely on the Community Health Aid Information Network (CHAIN), developed by ATP partner Mr. Mike Terry for the Norton Sound Health Corporation, the Alaska Telemedicine Testbed Project was designed to "replicate" the successes of CHAIN and to evaluate the use of "advanced telemedicine applications and technologies

in Alaska's narrow bandwidth environment. While the CHAIN was flawed, it had provided a solid model for ATP. Based on a client-server "messaging system," CHAIN was a clinical decision support system connecting the Village of Stebbins to Nome at 1200 baud dial-up. The ATTP proposal stated that it would "build on the lessons learned from CHAIN, and replicate the successes of CHAIN to the Alaska Native Medical Center, four regional medical "hubs," and five villages to deliver telemedicine services and to evaluate these services as being "as good or better" and for "cost and benefits." The goals of the ATTP proposal were to 1) build upon the successes of ATP by using a simple system that could be sustained for "rural partners," 2) create an "open non-proprietary system based on the public switched network, " 3) to demonstrate the use of telemedicine applications and technologies to re-engineer the transportation model of health care delivery model in frontier Alaska, 4) to evaluate "successes and failures" of the project to allow partners to develop their own strategies for success.

Alaska Telemedicine Testbed Project proposal

The original ATTP proposal was designed as a demonstration and evaluation of a simple business model for re-engineering "transportation dollars" back into "healthcare dollars" in Alaska. The study was based on the idea that healthcare was a "system in crisis" in Alaska. The delivery of healthcare services in rural Alaska was based on community health aids. However, a cursory analysis of healthcare delivery indicated that more than 90,000 patients per year were being air transported to Anchorage for healthcare and that healthcare professionals in rural Alaska experienced "professional isolation." Various demonstration projects regarding telemedicine suggested that Alaska could benefit from a sensible and "self-sustaining" telemedicine and telehealth system.

The basis idea behind the ATTP was to demonstrate that telemedicine could work in a "narrow bandwidth environment" in villages in frontier Alaska. The idea was to deliver healthcare services to people "where and when they needed it." The idea was to pick one or more clinical services that could prove that healthcare delivery could be re-engineered using "advanced" telecommunications and information technologies.

The basic proposal indicated that five regional sites each with five villages would receive a telemedicine workstation and software that would "replicate" and "build upon" the successes of CHAIN. From the point of view of ATP members, the ATTP proposal was intended to provide an extended demonstration project with the software and equipment serving as the sine qua non for the evaluation which itself was designed to prove or disprove three research questions: 1) that telemedicine applications were perceived by providers and patients as being "as good or better" than current healthcare services based on a transportation-model. This "satisfaction study" was designed specifically to determine if providers and patients would perceive telemedicine as an improvement on the delivery of their healthcare, 2) that "advanced telecommunications services," even at 1200 baud, would mitigate a feeling among healthcare professionals in rural Alaska of "professional isolation" and, consequently, improve the length of stay, or "survival" in their job in rural Alaska, and 3) that narrow bandwidth telemedicine applications and technologies provided a "benefit" that could be economically measured

and that the "total cost per transaction" for each clinical event was low enough to prove that narrow bandwidth telemedicine could be sustained by rural providers "...after the grant money was exhausted."

On June 12, 1996 the ATTP proposal was submitted by the Applied Science Laboratory of the University of Alaska Anchorage. The Alaska Native Health Board was named as the principle subcontractor for ATTP.

Section 5: Phase I of the Alaska Telemedicine Testbed Project (Oct. 1, 1996 – March 30, 1997)

On Oct. 1, 1996, the NLM announced a contract award for "Phase I" of the "Alaska Telemedicine Testbed Project" to the Applied Science Laboratory of the University of Alaska Anchorage. Immediately following this announcement, a workgroup was convened to begin the administration of ATTP.

1996 IHS baseline data and ENT decision

In 1996, 88,600 air transportations were paid by IHS for Alaska Natives traveling from rural Alaska to Anchorage for medial treatment. In 1996, these 88,600 air transportations broke into five discreet categories:

Clinic	% of cases	# of cases
Emergency Medicine	49.9%	47,000
Dentistry	19%	18,000
OBG/YN	13%	13,000
Dermatology	11%	6,000
Ear, Nose, Throat	10%	4,900

Upon examination, the technical and clinical workgroup decided that Emergency Medicine, while the overwhelming clinical need for rural Alaskans, was not an appropriate clinical focus for a "demonstration and evaluation" project. Likewise, OBG/YN was too biased for gender and age to be useful for ATTP. Dentistry looked promising, but the various Native Health Corporations each had widely different approaches to dentistry – some Native Health Corporations had dentists on staff while others did not. Also promising, dermatology had a growing data set from other projects, especially from the work of Dr. Doug Predneia at Oregon Health Sciences University. ENT was chosen as the clinical focus of ATTP because 1) it had no bias for age or gender, 2) it was a consistent problem for all five Native Health Corporations, and 3) ottis media is a common and persistent problem in northern climates. A decision was made to build a clinical system, with clinical protocols, that would focus on ENT, but would allow use for dermatology and for other clinical uses. However, only ENT would be used for collecting quantitative data.

Partnership selection: RFI process

During "Phase I," project tasks included 1) fine tuning the systematic and technical proposal, 2) determining the clinical focus of the project, and 3) determining the "rural partners." Weekly meeting were scheduled for technical and strategic planning.

During "Phase I" of ATTP, the "rural partnership" workgroup began to solicit interest from the 12 principle Native Health Corporations. This workgroup developed a "request for interest" proposal and communicated with the individual Native Health Corporations. This technical "request for interest," which became the basis of the working "memo of agreement" between the University of Alaska Anchorage and the Native Health Corporations, specifically required the "rural partners" to 1) understand that this was a research and evaluation project during which data acquisition was a critical feature of the operations, 2) participate in final design of hardware, software, and clinical procedures, 3) develop a telemedicine work team with a designated leader to facilitate the success of the project. The RFI indicated that the ATTP was to be a"ture partnership" and that, as such, the rural partner would contribute to the operations of ATTP by participating the development, training, support, data questionnaire development, distribution, and data collection. The rural partners were requested to provide "in-kind" support for the project and were told in the RFI that rural partners would be selected on the basis of their written responses that were required to be received by Jan. 12, 1997.

Of the 12 major Native Health Corporations, 11 proposals were received by the deadline. The "rural partnership" workgroup developed a weighted average system and evaluated the 11 proposals. The final scoring for the RFI was:

Native Health Corporation	**Score (100)**
Maniilaq Health Corporation	89 pts.
Bristol Bay Native Health Association	84 pts.
Norton Sound Health Corporation	83 pts.
Yukon-Kuskokwim Health Corporation	68 pts.
Kodiak Area Native Association	67.7 pts.

All responses to the RFI indicated strong support for ATTP and a willingness to provide "in-kind" support for the project.

Concurrent with the "rural partnership" workgroup, a clinical and technical workgroup began to "drill down" on the clinical and technical issues of the "Phase I" scope of work. Upon request, and following four months of delay, IHS provided transportation records for 1996 baseline year. A data request was made to IHS in Albuquerque for all subsidized medical air transportations during 1996. This did not include any patient transports by other modes of transportation nor any transportation paid by the patient or other party.

During Phase I, memos of agreement were signed with each of the four participating Native Health Corporations. In addition, workgroups were established to "fine tune" final participating villages, system hardware and software.

Section 6: Phase II of the Alaska Telemedicine Testbed Project (April 1, 1997 – Sept. 30, 1999)

the ANHB subcontract

As with any innovation project of this scope and scale, various problems developed concerning the role of the Alaska Native Health Board (ANHB) as the principle sub-contractor to the University of Alaska Anchorage (see Appendix 1, pp. 1.48 – 1.52). ANHB Project Manager was hired into the project without a full understanding of the core principles of the project. Numerous meeting were held to clarify the subcontractor relationship to UAA. However, it seems in retrospect that the ANHB Project Manager was driven by self-interest to make ANHB the focus of the Alaska Telemedicine Testbed Project. Voluminous email exchanges, detailed in quarterly project reports, attest to these "political problems."

While these problems consumed an enormous amount of time, and lead directly to the development of the Alaska Federal Healthcare Access Network (AFHCAN) proposal, these problems were managed through the offices of the UAA Vice Chancellor for Research and the Office of the Director of the Alaska Native Health Board. By October 1998, ANHB Project Manager was working directly on the AFHCAN proposal that was based on the preliminary research of the Alaska Telemedicine Testbed Project.

Developing baseline data instrument for "satisfaction study"

Beginning in January 1997, a satisfaction study work group was established to begin instrument development for the preliminary "satisfaction study." The purpose of this pre- and post-intervention instrument was to measure the perception of rural providers and patients regarding their healthcare delivery system for ENT.

Pre- and post-intervention instruments were developed. Using an interrupted time series model, each region was mailed survey instruments and informed consent forms. "Satisfaction Study" questionnaires were mailed beginning October 1997.

Over 8,200 "Satisfaction Study" questionnaires were returned (see Appendix 10, pp. 10.184 - 10.185).

Logistics of data collection

Concurrent with the development of the "satisfaction study," project personnel began to collect data from "Daily Medical Logs." These DMLs are the recorded

activities of the village's health clinics, collected at the regional hospitals. The DMLs were used to compute the number of clinical encounters in the village clinics and regional hospitals. These data were used as a baseline to compare against "satisfaction study" questionnaires and informed consent forms.

In an ideal world, the number of ENT cases recorded in the DMLs, the number of "satisfaction study" forms, the number of informed consent forms, and the recorded ENT encounters logged on ATW computers would be identical. Unfortunately, these numbers deviate as the result of data collection problems resulting from the remote and (often times) hectic pace of village health clinics. While the DML numbers most likely reflect the actual clinical traffic of the clinic (Community Health Aids have been filling in DML forms for 30 years), and cognizant of the onerous task of having patients fill out the "satisfaction study" forms and informed consent forms, nonetheless the difference in the final numbers for DMLs v. "satisfaction study forms" v. informed consent forms indicate that the health aids stated repeatedly: "...we don't have time to have patient's fill in the forms."

Finalizing system hardware and software

Given the "participatory nature" of this project, the ATW technical work group developed protocols for hardware and software decision-making that involved participating project members. Audio teleconferences were held with Information Technology and medical staff from participating Native Health Corporations.

In July 1997, a two-day hardware and software "shootout" was held at UAA. 45 participating partners met. Telemedicine hardware and software vendors were invited to demonstrate their products. While the basic project model for secure, "narrow bandwidth" "store and forward" data and image capture and transmission was straightforward, project partners evaluated computer systems, computer carts, monitors, keyboards, digital cameras, video digitizing boards, and video otoscopes. The core of the ATW, the video otoscope and digitizing board, received extremely close scrutiny (see Appendix 10, pp. 10.154 – 10.158). The AMD video scope and Matrox video board were chosen and preformed flawlessly (see Appendix 11).

Software challenges

While ATW system hardware decisions were rather straightforward, and would be determined, in part, by contract bidding constraints, system software issues plagued the project are were a direct cause of a one-year delay in project deployment.

The initial ATTP proposal cited the Norton Sound "Community Health Aid Information Network (CHAIN)" as a model that the project would expand upon. This "custom" system was based on FirstClass 2.1, a robust and secure client-server system software. This "cross platform" messaging system is easily customized. During the project, the Applied Science Laboratory would continue to customize FirstClass as the Alaska Telehealth System (ATS). ATS v. 5 and ATS v. 6 would be used during Phase III

of the project by the private sector with strong results. ATS v. 7 was developed as a "web-platform" using PHP and MySQL with promising results (see Appendix 8, pp. 8.17 – 8.28)

Unfortunately, various participating partners refused to deploy "any software not based on Microsoft. Indeed, this issue became a "make or break issue" for a number of the participating partners. Following this position, Medvision and Second Opinion were asked to submit bids for consideration. Medvision was chosen as the "low bidder" on December 15, 1997.

Despite assurances from Medvision that there software would be available, a nine-month software development delay pushed ATW deployment from March 1997 to October 1997. When finally developed and deployed, the Medvision software did not perform as well as ATS v.5. Medvision software was used for the duration of Phase II. Despite problems with Medvision software, training and support compensated for software "glitches." Analysis of software use by Community Health Aids indicates that they were able to use the software and "liked the software."

Logistics of Deployment

Developing, ordering, shipping, and building Alaska Telemedicine Workstations on-site proved to be a challenging and time consuming task.

Deployment logistics were managed by project team member, Ms. Heidi Hammond. Ordering 31 workstation carts, computers, video digitizing boards, AMD video otoscopes, accessories, and shipping all components necessary to villages scattered throughout rural Alaska was not as simple as "online shopping." Everything necessary for successful participation in the project had to be shipped to the individual villages. Specific instructions and procedures had to be developed in order to deployment teams to re-assemble workstations and get them "up and running" in remote villages. Little on-site support could be expected.

In addition to the logistics of shipping, deployment teams had to be scheduled at times convenient to village life and Community Health Aids. Deployment teams worked in minus 40-degree weather and worked in villages without amenities for visitors.

Alaska Telemedicine Workstations were successfully deployed in 38 rural sites. The workstations worked without failure during the project.

Logistics of training and support

A basic principle of the project was that Community Health Aids, who did not possess computer training, had to perceive ATW hardware and software as a "tool" that would allow them to provide "better" healthcare to their patients. This was achieved.

Consistent with the aims of the project, great attention was paid to system training and support. Due to the professionalism and experience of Ms. Denise Statz, training and support programs were developed (see Appendix 9). Training and support mechanisms ensured that every participating Community Health Aid was able to master and maintain mastery of ATW hardware and software throughout the project.

Problems of personnel turnover

Despite all precautions, personnel turnover created problems with final project achievements. Personnel turnover affected UAA the work team. Dr, Shelly Theno, principle team member who developed the "satisfaction study" pre- and post-intervention instruments, Dr. Askar Choudhury, principle team member responsible for the satisfaction study, and Dr. Dennis Fisher, Director of the Evaluation Team, all left UAA for other academic appointments. In addition, various key personnel working for the participating Native Health Corporations were not able to fulfill their commitments to the project. In one tragic event, a key member of Region Four was stricken with cancer and left Alaska. And, while high personnel turnover is ever present in Alaska, the loss of the key person in Region Four was one of the key reasons that Region Four was not able to complete their commitments to the project.

Personnel turnover in key project positions greatly influenced final data results and project successes.

Partner Memos of Agreement

Consistent with problems of project personnel turnover, fulfilling stipulated contract commitments proved difficult for all but one region. Various ongoing "facts of life" in rural Alaska contributed to an inability of project partners to fulfill the requirements of the signed Memos of Agreement (see Appendix 2, pp. 2.1 – 2.16). Most prominent, the dominant culture of Alaska rural healthcare created problems of expectations and fulfillment during the project. Simply, rural Alaska organizations are understaffed and overworked, with enormous responsibilities for the well being of the residents of the villages. In addition, participating organizations are not used to the demands and rigors of "research models." While very interested in the idea of telemedicine, few were prepared for the rigors of data collection.

Overall, participating Native Health Corporations worked to fulfill the specifics of their memos of agreement. However, the day-to-day demands of healthcare delivery, with diminishing budgets and increasing responsibilities, mandated that data collection and submission would be "less than perfect." In addition, as mentioned above, loss of key personnel demanded that telemedicine data collection took a "back seat" to providing ongoing healthcare to patients. In Region Four, the lack of compliance with the details of the memo of agreement seem to be a direct result of lack of staff, mid-management "follow-up," and mid-management commitment to the project.

Problems with no-cost contract extension year

Attendant with problems of personnel turnover, the one-year software delay in system deployment necessitated a one-year "no cost contract extension." While a great opportunity to "recover lost time," this additional year was not part of the memo of agreement and was perceived by rural partners as an "unnecessary" burden on them for data collection. With project hardware and software working in Regions One, Two, and Three, rural project partners had little interest in what they perceived as a great burden to submit "satisfaction study" forms.

While Regions One, Two, and Three continued to use "NLM equipment," data was no longer regularly provisioned. In addition, AFHCAN received a commitment for $32M in October 1999 to "expand the NLM project" to all 190 villages in rural Alaska. Based on their funding, AFHCAN began to develop a hardware and software system based on "improvements to the NLM project." While involved in building an organization scaled to the scope of their funding, ANHB activities were subsumed by AFHCAN and little attention was paid to the NLM "no-cost contract extension." Fortunately, AFHCAN continued to use "NLM equipment" and did, eventually, provision data through June 2000. However, in action plan, rural partners became confused about responsibilities to provision data and, perhaps, more excited about the prospect of "new equipment." Consequently, system use and data provisioning dropped precipitously. Simply, and given original memos of agreement, rural project partners concluded that the project was concluded.

Section 7: Phase III of the Alaska Telemedicine Testbed Project (Oct. 1, 2000 – Sept. 30, 2001)

Problems with scope and timing of Phase III

In November 2000, UAA was offered and accepted a one-year contract extension for the Alaska Telemedicine Testbed Project. The focus of this contract extension was to expand ATW hardware and software to seven private sector sites in rural Alaska serving Native and non-Native populations.

While an obvious extension of the successes of the project, this contract extension occurred simultaneously with the "explosion" of AFHCAN and the development of the Alaska Telemedicine Advisory Council (ATAC), funded through AFHCAN. And, while seven rural sites where chosen from a pool of 22 possible participants, AFHCAN and ATAC activities created enormous confusion among private sector health care providers.

In addition to the confusion regarding the "old NLM equipment" and the "new AFHCAN hardware and software" (despite the fact that AFHCAN hardware and software were obvious extensions of – and improvements to – the Alaska Telehealth Workstation hardware and software. AFHCAN hardware improvements largely consisted of fasters CPUs and replacing a 17" "25.pitch" cathode ray tube monitor with a 15" "28.pitch" LCD monitor; AMD otoscopes remained the heart of the "store and

forward" system. AFHCAN software "scrapped" Medvision and replaced this system software with Microsoft active server pages and SQL database. Indeed, AFHCAN made special provision to continue to use "NLM otoscopes" so as not to duplicate equipment and "waste money."

Despite these complications, workstations were deployed to seven rural sites running ATS v. 6. Work was continued on ATS v. 7. Training and support materials were updated and amended. Memos of agreement were developed for rural provider and urban consultant.

Despite the success of the extension of the project to the private sector sites, the logistics of deployment, problems of rural provider turnover, data provisioning, training and support were nearly identical to the problems encountered in Native Health Corporations.

In addition to the "standard" problems of deploying the Alaska Telemedicine Workstations in rural Alaska, the private sector deployment raised the problem of reimbursement. This problem was solved through the cooperation of the "Alaska Telemedicine Efficacy Project." Modestly funded by ATAC, training and support for these seven private sector sites with provided by Ms. Kathe Boucha and Ms. Debbi Kiley. Final data from the "Efficacy project" indicate that the private sector was perhaps less willing to provision data.

Section 8: Conclusion

The Alaska Telemedicine Testbed Project began as a three-year project to demonstrate and evaluate the use of telecommunications and information technologies to improve the delivery of healthcare in rural Alaska. At that time, it was not preordained that a system could be developed to work in rural Alaska; it was not preordained that "store and forward telemedicine" was clinically valuable; and it was not preordained that Community Health Aids would be able to embrace a new technology.

Despite problems associated with two contract extensions, problems associated with a series of complex "partnerships," and with the timeliness of project reporting, ATTP must, nonetheless, be viewed as a qualified success. The Alaska Telemedicine Testbed Project did something that had never been done before.

The Alaska Telemedicine Testbed Project developed and deployed a secure "store and forward" telemedicine system in 37 sites in "frontier" Alaska (and one unit in Anchorage). Working with a "narrow bandwidth" telecommunications system capable of 900 baud measurable throughput to rural healthcare (circa 1997), separated by a vast geography, and bridging a "rural-urban divide," as well the different languages, cultures, and politics of four Native Health Corporations, with their 26 tribal organizations. The Alaska Telemedicine Testbed Project generated over 6,600 ENT encounters with over

ATTP ENT Data Matrix: Oct. 1, 1996 - Sept. 30, 2001

Monthly Averages per village (based on 190 villages)		
	Examined Daily Medical Log Encounters	203
	Recorded Ear Cases	23
	Ear Cases requiring "Radio Medical Traffic"	14
Yearly Averages per village (based on 190 villages)		
	Examined Daily Medical Log Encounters	2430
	Recorded Ear Cases	274
	Ear Cases requiring "Radio Medical Traffic"	163

ATTP Total "Radio Medical Traffic" Ear Cases using ATW from 11-1-98 through 10-1-01
(based on 38 deployed ATWs)

	1 or 2 person encounter	3 person encounter	4 person encounter	total images captured and sent	**TOTAL ENT cases**
Region A					
Hospital	40	62	0	121	102
Village 1	7	153	0	479	160
Village 2	58	202	0	412	260
Village 3	19	112	0	357	131
Village 4	88	393	0	903	381
Village 5	60	337	0	836	397
Village 6	55	134	0	475	189
Village 7	107	315	0	976	422
Village 8	68	234	0	936	402
Village 9	68	480	0	1232	548
Village 10	145	270	0	824	415
Village 11	101	321	0	838	422
Region A subtotal	**816**	**3013**	**0**	**8389**	**3829**
Region B					
Hospital	62	81	0	148	143
Village 1	46	187	0	453	233
Village 2	33	122	0	483	155
Village 3	38	143	0	512	181
Village 4	79	251	0	675	330

Village 5	64	287	0	764	351
Village 6	NA	NA	NA	NA	NA
Region B subtotal	**322**	**1071**	**0**	**3035**	**1393**
Region C					
Hospital	57	78	0	134	135
Village 1	31	187	0	435	218
Village 2	23	145	0	368	168
Village 3	87	383	0	814	470
Village 4	51	127	0	438	178
Village 5	19	97	0	321	116
Region C subtotal	**268**	**1017**	**0**	**2510**	**1285**
Region D					
Hospital	NA	NA	NA	NA	NA
Village 1	NA	NA	NA	NA	NA
Village 2	NA	NA	NA	NA	NA
Village 3	NA	NA	NA	NA	NA
Village 4	NA	NA	NA	NA	NA
Village 5	NA	NA	NA	NA	NA
Region D subtotal	**NA**	**NA**	**NA**	**NA**	**NA**
ANMC	NA	NA	NA	NA	NA
ANMC subtotal	**NA**	**NA**	**NA**	**NA**	**NA**
Region E					
Clinic 1	NA	34	NA	NA	34
Clinic 2	NA	6	NA	NA	6
Clinic 3	NA	35	NA	NA	35
Clinic 4	NA	5	NA	NA	5
Clinic 5	NA	29	NA	NA	29
Clinic 6	NA	NA	NA	NA	NA
Clinic 7	NA	NA	NA	NA	NA
Region E subtotal	**NA**	**109**	**NA**	**NA**	**109**
Total	**Total**	**Total**	**Total**	**Total Images**	**Total ENT cases**
	1406	**5210**	**0**	**13,934**	**6,616**

13,000 digital images. In addition, thousands of encounters were generated for dermatology and emergency medicine.

The Alaska Telemedicine Testbed Project proved that "advanced" telehealth services can be securely and effectively delivered to the most remote places in Alaska, and by extension, the United States, and the world (see Appendix 10).

Lessons learned

The major lessons learned from the Alaska Telemedicine Project should be obvious in retrospect. The most basis lesson is that if a process re-engineering project is built around a sensible "tool," and if the proper training and support mechanisms are developed and sustained, dedicated individuals will use their new "tool" to improve their environment.

The Alaska Telemedicine Testbed Project was based on the following presumptions

- build an evaluation model before implementing technology; you cannot evaluate success or failure without an evaluation model and evaluation tools
- build a "tool" that takes "advantage" of existing technologies and is not contingent on unavailable technologies
- focus on the needs of the end-user.

Despite problems with project management, timeliness of project reporting, and the complexities of a vast project, the equipment developed and deployed, and the data generated, suggest that the Alaska Telemedicine Testbed Project was a qualified success. The legacy of the project is the realization that telecommunications and information technologies can improve the delivery of healthcare services throughout "frontier" Alaska.

Alaska Telemedicine Testbed Project
NLM Contract # NO1-LM-6-3540

Final Report

submitted by

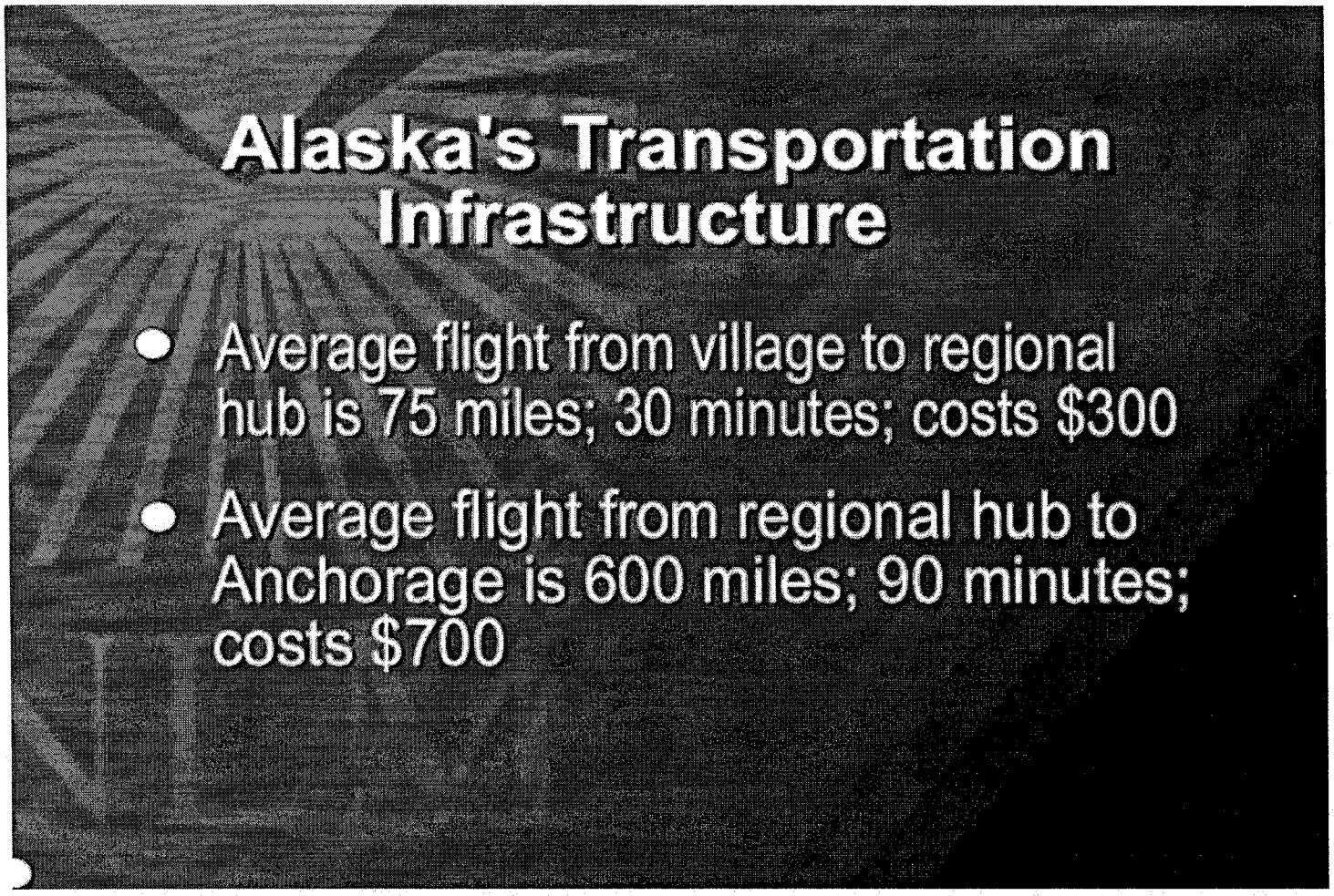
Frederick W. Pearce, Ph.D.

Jan. 28, 2003

Goals of project:
develop, test, deploy, evaluate
the use of telecommunications
and information technology
to deliver healthcare
"where and when it is needed."

Project Constraints

- Participating villages were hundreds of miles from Anchorage
- Alaska's satellite telecommunications backbone
- 1997 throughput study reveals average of 900 baud to village clinic
- 2000 throughput study reveals average of 1,900 baud to village clinic


Alaska's Transportation Infrastructure
Average flight from village to regional hub is 75 miles; 30 minutes; costs $300
Average flight from regional hub to Anchorage is 600 miles; 90 minutes; costs $700

ATTP Phase One
• Memos of Agreement negotiated for baseline data collection, system development

h.1

ATTP Phase One

- Proposals from 11 of 12 Native Health Corporations
- Jan. 12, 1997 Request-For-Interest proposals due date
- Request-For-Interest proposals judged by weighted averages

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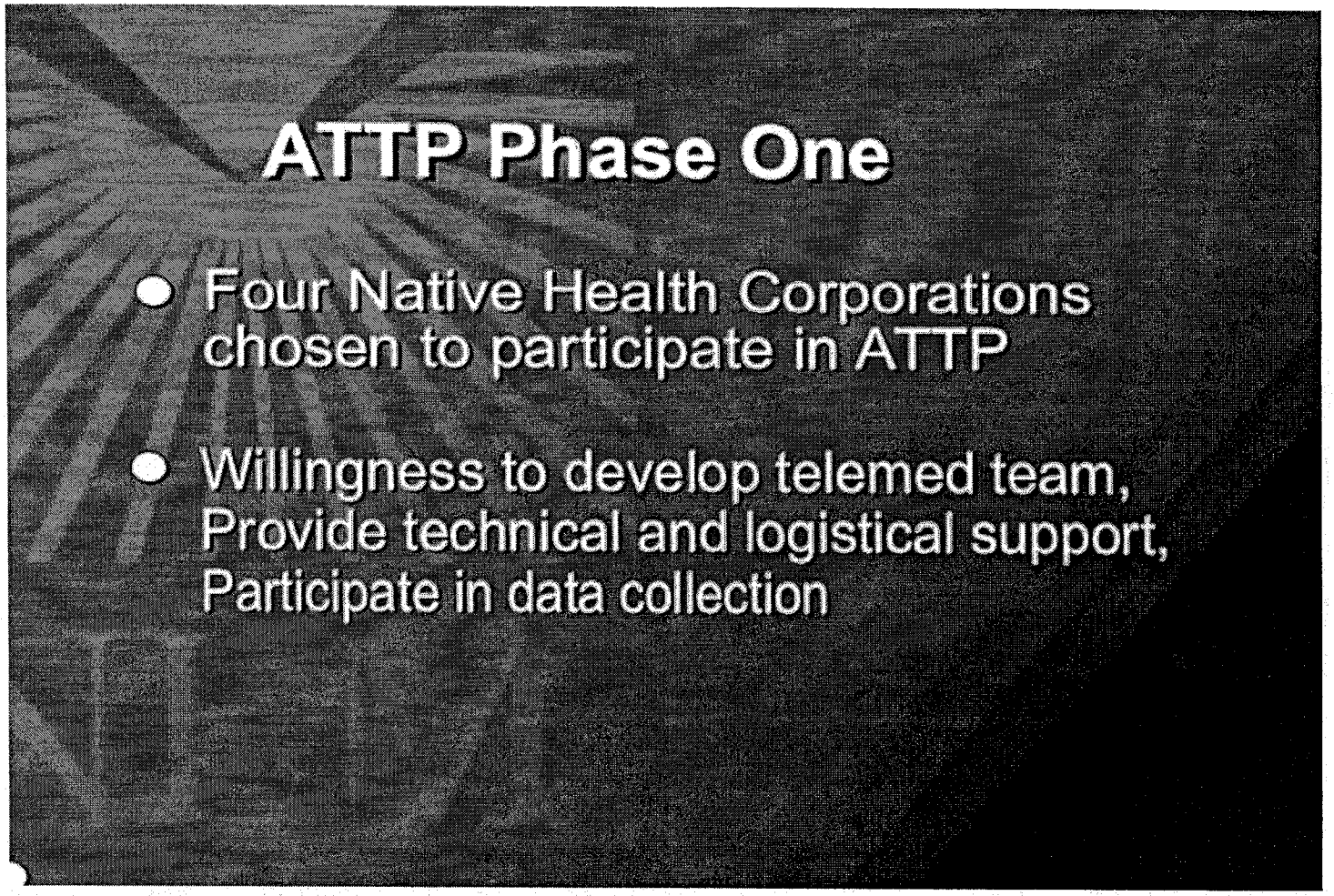
ATTP Phase One
Four Native Health Corporations chosen to participate in ATTP
Willingness to develop telemed team, Provide technical and logistical support, Participate in data collection

Participating Healthcare Organizations
Maniilaq Health Corporation
Norton Sound Health Corporation
Bristol Bay Area Health Corporation
Yukon-Kuskokwim Health Corporation
7 Private Sector sites serving Native and non-Native populations

National Library of Medicine
RFP-NLM-96-105/MVA
The Alaska Telemedicine Testbed Project

Technical Proposal

submitted by

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University of Alaska Anchorage
Anchorage, AK 99805

I Introduction: *The Alaska Telemedicine Project*

This contract proposal is submitted by the Applied Sciences Laboratory at the University of Alaska Anchorage on behalf of the *Alaska Telemedicine Project,* a consortium of Alaskan health care providers, telecommunications carriers, and the State of Alaska. The *Alaska Telemedicine Project,* which has been actively involved in telemedicine activities in Alaska for the last two years, and is recognized for its leadership in telemedicine activities in Alaska. Current members of the *Alaska Telemedicine Project* include: The University of Alaska Anchorage, Alaska State Department of Health and Social Services, Alaska State Hospital and Nursing Home Association, Alaska Native Health Board, Alaska Center for Rural health, Alaska Rural Development Council, Southeast Conference, Copper River Economic Development Council, International Union for Circumpolar Health, The Northern Forum, the WAMI Rural Telemedicine Network, Providence Alaska Health Systems, Alaska regional Hospital, Bartlett Memorial Hospital, Valley Hospital, Alaska State Division of Emergency Services, Alaska Federal Healthcare Partnership, the Third Medical Group at Elmendorf Air Force Base, the U. S. Department of Veteran's Affairs, Alaska Native Medical Center, Bristol Bay Area Health Corporation, Chugachmiut Health Care Program, Eastern Aleutian Tribe, Inc., Kodiak Area Native Association, North Slope Borough Department of Health, Maniilaq Association, Norton Sound Health Corporation, Southcentral Foundation, Tanana Chiefs Conference, Yukon-Kuskokwin Health Corporation, AT&T Alascom, GCI, ATU Telecommunications, United Utilities, and TelePresence of Alaska.

Health Care in Alaska

Health care in Alaska is divided into three separate systems: Native health care through the Indian Health Service, and Native health corporations; military health care; and civilian health care. Each of these health care systems has different practices, technical capabilities, and approaches to the use of technology for the delivery of health care. These three systems often compete for patients and health care dollars.

Health care delivery in Alaska, called a "system in crisis" in a 1994 report by Commonwealth North, is based on transporting people to facilities and information systems. This is especially costly where, because of vast distances, climate, and topology, air transportation is the only means of moving patients from rural villages to rural Alaska health care facilities or from rural health care facilities to urban health care facilities. This is also costly where community health aids, often with minimal training, are asked to make life-effecting decisions without access to expert information beyond a voice phone call to a physician.

This transportation-based model of health care delivery often relies on community health aides to make diagnoses that lead to decisions to transport the patient. It is commonplace for these health aides and their "phone doctors'" to err on the side of caution. Indeed, a cursory examination of health care transportation records indicates that there is "cautious error" and inefficiency in this model of health care delivery.

In addition, Alaska's transportation model of health care delivery fosters a sense of "professional isolation" both in terms of "lack of communication" and in "lack of professional training" and access to "continuing medical education." Transporting physicians, nurses, or community health aids/practitioners (CHA/Ps) to meetings held in urban centers, or transporting them to conferences "outside" Alaska means that health care dollars are flowing outside the clinic and region and that these health care workers cannot be serving their clients.

The fragmented nature of health care delivery in Alaska, and Alaska's satellite-based "narrow bandwidth" telecommunications infrastructure, geography, climate, population density, and ethnography, create problems for health care providers that can be best served by delivering health care "across a distance" through narrow bandwidth telecommunications and information technology based on "dial-in" access and internet. Narrow bandwidth applications scaled to Alaska's telecommunications infrastructure, like e-mail; internet-based access to health care information and medical libraries; and internet-based access to consultative quality medical imaging technology promise to extend the reach of level three health care facilities to level two facilities; level two facilities to level one; and making villages with only community health aid facilities capable of interaction with a network of health care information extending consultative and diagnostic capabilities to the village clinic, emergency room or the practicing physician. In addition, telecommunications-based health care applications make possible the extension of medical information and health care education to rural health care providers.

The burgeoning interest in "telemedicine" in Alaska is a response to the enormous changes that have occurred and will occur in health care and health care delivery mechanisms in the State. These changes are being imposed on health care providers, funding agencies, regulatory agencies, and health care consumers by changing economics and changing demographics. As federal health care contributions to health care systems decrease, and as the population of Alaska changes, telemedicine is being seen by its proponents as a strategy for cost containment and for increasing the quality of health care delivery that, in Alaska, has been predicated on a transportation model.

Responding to these challenges brought about by shrinking dollars and by changing populations, telemedicine applications are being deployed in Alaska from the "grass roots" level. As this occurs, a need has developed for a comprehensive evaluation mechanism that can provide valid and reliable information to policy makers as they attempt to improve the quality of health care delivery while containing the costs of health care.

II Statement of Work

1. Objectives

This objective of this contract is to replicate existing and developed Alaska telemedicine testbeds by modifying, interfacing, and expanding successfully deployed narrow bandwidth telemedicine technologies and applications and to evaluate the impact of these telemedicine technologies and applications on the health care system in rural Alaska for cost, quality of care, and access to care by rural Native Alaskans where and when it is needed. Members of the *Alaska Telemedicine Project* believe that these successes can serve as models for other rural regions of the United States and for the developing nations.

This contract will build upon the organizational successes of the *Alaska Telemedicine Project* to coordinate the replication of scaled, tested approaches to telemedicine and health care infomatics in rural Alaska. Projects associated with the *Alaska Telemedicine Project* currently include Providence Health Systems in Alaska's teleradiology demonstration projects, Third Medical Group at Elmendorf Air Force Base's medical video teleconference demonstration projects, the Yukon-Kuskokwim local area network (LAN) demonstration projects, the Washington-Alaska-Montana-Idaho (WAMI) teleradiology and medical infomatics demonstration project, the Barrow video teleconferencing demonstration project, the Bartlett-Virginia Mason video teleconference project, the Alaska Native Medical Center Teleradiology Project, the Nome CHAIN project, and other examples of need-based responses to changes being imposed on health care delivery. Other projects, including Indian Health Service (IHS) Village Telemedicine Project, and the Alaska Telemedicine Infomatics Project are awaiting funding.

Each of these projects is based on responding to the needs of the community. Each is a local response to a local problem created by changes in economics and demographics. Each project requires an evaluation yet lacks the statistical expertise to evaluate the individual project within the entire context of health care delivery in Alaska. Indeed, these uncoordinated projects tend to duplicate each other given similarities based on characteristics of clientele and characteristics of technology. For these reasons, the *Alaska Telemedicine Project* has attempted to integrate these individual "players" into a consortium which can share successes and failures to demonstrate, test, and evaluate the range of applications that can be sustained in Alaska. At this time, the *Alaska Telemedicine Project* is comprised of over 40 members representing a broad spectrum of civilian, military, and Native medicine, educational institutions, and telecommunications carriers throughout the State. The *Alaska Telemedicine Project* has sponsored various telemedicine demonstration projects designed to identify and test the applicability of telemedicine in Alaska.

This contract will be executed within an environment in which the University of Alaska, and civilian, military, and Native health care organizations will develop and promote access to internet-based medical and health care bibliographic databases and electronic publications, practice guidelines, expert systems, as well as a computer-based patient records management system in selected sites in rural Alaska. Confidentiality will be maintained through the use of programs that will allow electronic health care data to be shared among selected rural Alaska villages, their regional health care "hub," and on to tertiary care facilities in Anchorage.

A goal of this contract is to provide selected health care facilities in rural Alaska with access to e-mail, dial-in, CD-ROM and internet-based health care and medical information, comprehensive medical histories, and narrow bandwidth health care and medical imaging capabilities. This project will provide rural health care practitioners with connectivity via dial-in access and internet. Isolated health care providers throughout Alaska will connect to local information servers or to information servers in Anchorage to exchange information. This e-mail system will attempt to reduce "professional isolation," the most often cited reason for the extraordinarily high turnover rate among health care workers in rural Alaska. Information "gateways" will provide access to medical libraries, access to World Wide Web servers, and to information sites like Rural Health Care, Rural Telemedicine. Rural Mental Health Care, InterPsych, and the University of Alaska Anchorage School of Nursing and Health Sciences. In addition, this e-mail system will allow health care providers to move consultative quality medical images from rural sites to regional and urban hubs. This project will use narrow bandwidth technologies and applications to "take advantage" of Alaska's satellite-based narrow-bandwidth environment to provide access to health information. As expected improvements in internet connectivity are implemented in rural Alaska, this system will become fully internet based. Implementation, training, and support will be provided by the *Alaska Telemedicine Project* partners that include health care facilities throughout the State, the University of Alaska, and the telecommunications carriers.

This contract will apply developed and evolving evaluation methods to the *Alaska Telemedicine Project* testbed to evaluate the impact of telemedicine in a narrow bandwidth environment using five evaluation models.

2. Approach

This contract is predicated on existence of a viable consortium of Alaskan health care organizations which bring diverse experience and expertise to this project. It is based on the pioneering work performed by members of the *Alaska Telemedicine Project*, including the Norton Sound Health Corporation. It seeks to replicate the successes of the Norton Sound Community Health Aid Information Network (CHAIN) Project which uses "off-the-shelf" telecommunications and information technologies and applications to improve the quality of health care "at a distance."

Scaled to rural Alaska's telecommunications infrastructure, the Norton Sound Health Corporation CHAIN Project has demonstrated the uses of narrow bandwidth technologies and applications linking 15 rural villages to the regional health care facility in Nome. The CHAIN Project has recorded 200 consultations that have resulted in improved health care to its rural villages with a significant reduction in travel cost. The proposed project is based on the narrow bandwidth characteristics of telecommunications in rural Alaska and is focused on the village and the end-user. The purpose of this project is to evaluate the impact of this project on the delivery of health care in Alaska.

This project is based on the current public switched network in Alaska and articulated plans by Alaska's telecommunications carriers to provide improved service to rural Alaska. The current telecommunications capabilities in rural Alaska are based on voice-grade circuits which are connected via satellite uplink/downlink from the rural village to one of three "toll stations" located in Anchorage, Fairbanks, and Juneau. This system, developed in the mid-1970s, requires a "double satellite hop" for voice and data from village to village (village A voice, video or data uplinked to Aurora II; downlinked to the Anchorage toll center; uplinked to Aurora II; downlinked to village B). This "double hop, with attendant transmission time delay, makes data transmission rates over 9.6 Kb difficult. In addition to voice grade circuits, AT&T Alascom's "AlaskaNet" is a X.25 network to 85 sites in rural Alaska, This network, scheduled to be upgraded to a frame relay system, allows local dial-in to an X.25 PAD and provides 9.6 Kb data transmission. General Communications, Inc. (GCI), Alaska's second long distance telecommunications carrier, has just received permission from the Alaska Public Utilities Commission to begin experimental service in rural Alaska. Both companies, which are members of the *Alaska Telemedicine Project,* are committed to providing internet-based services to rural Alaska.

Building upon the broad range of "local" telemedicine projects and current capabilities (and planned upgrades) of the public switched network, this project proposes to "take advantage" of rural Alaska's narrow bandwidth telecommunications infrastructure by building a "dial-in" and internet-based testbed for evaluating the impact of telemedicine on the health care system in selected sites in rural Alaska for cost, quality, and access to care. This project will use AT&T Alascom's and GCI's public switched network with 1-800 dial-in, X.25, and internet capabilities to:

1. replicate and expand the Norton Sound Community Health Aid Information Network (CHAIN) testbed project by linking 25 rural villages to four selected second-level regional health care facilities and through the Alaska Native Medical Center's to other tertiary health care facilities in Anchorage by providing one of the above capabilities with selected "off-the-shelf" telecommunications and information technologies and applications; to

2. provide narrow bandwidth medical imaging capabilities for diagnosis and consultation to villages and regional "hubs" using "off-the-shelf" computers, hubs, hardware, software, digital cameras, and selected digital medical equipment; provide training and support for implementation; to

3. deliver e-mail to project participants in primary care, secondary, and tertiary care facilities by building on existing systems throughout the State;

4. provide world wide web access to bibliographic databases, electronic publications, knowledge-based information via the *Alaska Telemedicine Project* medical infomatics web server (http://telemedicine.alaska.edu) including National Library of Medicine, the University of Alaska Anchorage Medical Library ; and provide access to Anchorage-based (and internet-based) expert systems to improve the quality of diagnosis and consultation to health care providers in rural Alaska; and

5. interface the regional community health aid information network (CHAIN) "hub" database with the Indian Health Service Resource Patient Management System (RPMS) via HL7 and other international standards; to

6. provide a comprehensive history of clinical encounters on site in rural Alaska by adding community health aid encounter information to the Indian Health Service Resource Patient Management System (RPMS);

7. implement a narrow bandwidth desktop video teleconferencing service using Anchorage's local carrier, ATU Telecommunications' new ISDN service for third party consultation between the Alaska Native Medical Center (primary referral site) and secondary referral sites: The Third Medical Group at Elmendorf Air Force Base, Providence Alaska Medical Center, and the School of Nursing and Health Sciences at the University of Alaska Anchorage; to

8. improve remote diagnosis and third party consultation to rural Alaska by developing a patient records management "hub" in Anchorage at the Alaska Native Medical Center and explore sharing information from these databases with The Third Medical Group at Elmendorf Air Force Base, Providence Alaska Medical Center, and the School of Nursing and Health Sciences at the University of Alaska Anchorage for specialty consultation and referral when needed; and

9. evaluate the impact of these narrow bandwidth telemedicine applications on the health care system in Alaska for cost, quality, and access to care for rural Native Alaskans n 25 remote villages, four regional hospitals/health centers, and three tertiary medical centers, and the University of Alaska Anchorage's School of Nursing and Health Sciences and Medical Library.

Development of interfaces, equipment installation, training and support throughout the project will be provided by the major subcontractor for the project, the Alaska Native Health Board. Additional training and support will be provided by Alaska Native Medical Center, Providence Alaska Medical Center, and the University of Alaska Anchorage. This project represents a unique opportunity to integrate several on-going and planned medical and health care information projects that are already funded, with an expanded village-centered demonstration project. Together, these projects will allow health care to be delivered to a point of need to residents of some of the most remote villages in North America.

This multi-agency, multi-faceted project will combine existing telecommunications and information technologies and applications to help meet the needs of rural Alaska health care providers. It includes four sub-projects which will maximize the sharing of health care information with higher level. lower-level, and parallel providers. All sub-projects are tied together by the characteristics of Alaska's telecommunications infrastructure. These sub-projects are:

- narrow bandwidth delivery of medical and health care information via www servers and e-mail;
- low technology, narrow bandwidth telemedicine applications at three levels of care;
- electronic health data sharing at three levels of care;
- the creation of a multi-provider, multi-agency, state-wide database available three levels of care;

- decision support software access at three levels of care.

3. Methods

The purpose of this contract is to develop and test an evaluation mechanism that can help decision makers, like regulatory and funding agencies, make difficult decisions regarding the implementation of telemedicine systems. This contract will develop a baseline of information to use as a "benchmark" for the change that the introduction of telemedicine techniques will necessarily bring about. This "baseline" research will use medical records regarding patient transfer and the cost of transportation-based health care delivery and will include a review of the State Trauma Registry; a review of the Department of Health and Social Services; a review of the Indian Health Services; and a review of the Third Medical Group records. This review process is designed to develop a baseline of information regarding the costs of health care delivery based on transportation models.

This project will use five (5) evaluation models that are designed to analyze the numerous issues relating to the development of telemedical systems in Alaska. Based on partnerships with consortia members, these evaluation models will be based on both baseline information currently compiled by various health care agencies, as well as reporting methods that will take advantage on on-site and "research-at-a-distance" techniques.

This contract will fund the following evaluation methods for 30 months in quarters three through eleven.

a) A Profile Grouping of Medical Treatment Sites in Alaska

This evaluation method will use a cluster analysis techniques designed to develop group profiles on health care delivery sites. This analysis will look at the myriad of issues involved in delivering health care at a distance. Lead evaluator, Dr. Fenaughty, will focus of the following:

There are approximately 280 sites in Alaska at which medical treatment is provided. These range from tertiary-care hospitals in Anchorage, to regional facilities in Fairbanks, Kotzebue, Juneau, Bethel, Nome, etc., to primary care facilities in rural villages. The traditional method for delineating these health care facilities is based on size and medical degree of staff. The Profile Grouping and Cluster Analysis will seek to "cluster" these medical facilities using variables based on present and future telemedicine "descriptors."

The basic question posed by this Evaluation Project is: can these 280 sites be grouped into a number of sites, themselves homogeneous, while different from the other groups? Secondarily, if some of the 280 sites have some form of telemedical applications, can predictors be developed from these sites that could predict the likelihood of telemedicine application success or failure of the other sites in the same group, if and when they were also to obtain grants or moneys to begin telemedicine operations?

These questions can be answered most effectively by a cluster analysis of sites predicated on information, or descriptors, that can be used to construct profiles of each site. This cluster analysis will be performed on these site descriptor profiles. There are a number of descriptors of sites that can be used for such an analysis that have been identified and developed by members of the Telemedicine Project. These include connectivity, network support, medical hardware, technical training, infomatics systems, medical education, funding mechanism, service level and consult type.

Based on these and other "descriptors," this evaluation model will facilitate the development of construct scales (whether nominal, ordinal, or additive) for each of these

descriptor variables. The project evaluation team will obtain data from each site, ba these "descriptors" so that each site may be scaled on each of these "descriptors." will constitute the profile of each site. The evaluation team will use the CLUSTAN (Wishart, 1987) package to perform the cluster analysis.

Replicability will be performed in two different ways. The first approach v compare the agreement between two different partitions of the same dataset using th Adjusted Rand Statistic (Fisher & Hoffman, 1988; Hubert & Arabie, 1985). If the robust structure to the data. then there should be a high Adjusted Rand Statistic. Th second approach will randomly split the sample into two subsamples. The same cl analysis method will be used on each. Correlation's between mean profiles of the c of the two random subsets will be compared. If there is good replicability using thi robust structure, then each profile in one of the subsets should have a high correlat only one profile of the other subset.

In addition to replicability, the evaluation team will assess what is called nat (something analogous to validity). The output of the cluster analysis will be read in (SAS Institute, 1990) and groups of sites or clusters will be used as levels of the independent variable in one-way analysis of variance (ANOVAs) with occupancy ra acuity rate used as dependent variables. If the clusters are good predictors (i.e., the clusters are significantly different on mean occupancy rate and/or mean acuity rate) variables not used as input to the cluster analysis, then the evaluation can conclude t clusters are "natural" or valid in that they have predictive utility.

When the evaluation team is able to obtain clusters that are both replicable ar natural, these clusters will have usefulness in some of the other analyses that will be in this evaluation project.

b) A Satisfaction Analysis

This evaluation method will use an "interrupted time series techniques" designed to measure primary care provider, patient, and consultant satisfaction." Lead evaluator Dr. Choudhory.

1) The primary objective of this type of analysis is to determine whether telemedicine applications can increase access to "better" health care for rural Alaska. This objective can be achieved by monitoring the number of patient visits (or facility occupancy) at the hospital or clinic over time. These results are twofold. First, there be a change (possible increase) in the number of patient visits to the local health care after telemedicine is introduced. Second, if telemedicine is successful, the number patient visits will consistently rise over time provided that the population size is rela constant.

Two different statistical time series models will be applied in analyzing and these hypotheses:

Model-I: This model will use spline function (Seber & Wild, 1989) to test t hypothesis that there is a structural change after the establishment of telemedicine. will require an optimization programming from an IMSL subroutine using a FORTR program to estimate a nonlinear "likelihood" function. A "likelihood ratio test" (Juc al., 1985) for the hypothesis of "no switching" can then be carried out.

Model II: This model will use a time series regression model to observe if t number of patient visits increases over time after the introduction of telemedici statistical assumptions such as autocorrelation, heteroscedasticity, etc. will be teste necessary correction (Choudhury, 1994, Judge et al., 1985) will be taken to obtain models.

The second objective of this type of analysis is to determine if telemedicine is a satisfying experience for patients. primary and secondary care providers. This is needed to establish whether telemedicine not only provides increased access to health care delivery, but that it also improves (measured in satisfaction level) the existing health care system (or a viable alternative to the model health care delivery system). This hypothesis can be statistically analyzed by using similar time series models as referenced above.

2) A profile of psychometric properties of satisfaction indices will be developed. Because telemedicine activities affect patients, providers, and consultants, it is important to find out how each of these perspectives differs as to their satisfaction with the telemedicine experience. To capture this information, Douglas Perednia, M.D. (1995) has developed several different satisfaction scales to be used by patients, primary care providers, and consultants. These instruments must be assessed for the psychometric properties of reliability and validity.

In addition to assessing the reliability of the satisfaction scales, we will also test their validity. There are several different types of validity. The type we shall consider here is "criterion" validity. This is defined as the correlation of a scale with some other measure under study (Streiner & Norman, 1989). "Criterion" validity is divided into concurrent validity and predictive validity. Concurrent validity is the correlation of the scale with another criterion measure that is obtained at the same time as the scale score. Predictive validity is the correlation of the scale score with some criterion measure which is obtained at a later point in time than the scale score.

Validity assessment with the Perednia satisfaction scales will be predictive validity in that satisfaction scores will be used to predict later use of telemedicine applications. The hypothesis being that those individuals who have a higher satisfaction with their early telemedicine experiences will be more likely to use telemedicine in the future.

c) A Survival Analysis

This evaluation method is based on historical information and "time to event" analysis of the rate of health care provider turnover and the differences between sites that have and that do not have telemedicine. Lead evaluator Dr. Fisher.

One of the pressing and reoccurring issues of health care delivery in Alaska is how long health care practitioners stay on the job. This is an especially vexing problem in rural Alaska. Average lengths of stay of between 11 and 13 months are cited as "not unusual." The most frequently cited reason for leaving a health care delivery practice is "professional isolation," a function of physical isolation in a transportation model of health care delivery. One of the questions raised by the *Alaska Telemedicine Project* is whether having access to electronic mail (e-mail) and other communications applications provided by the Project will reduce the feeling of professional isolation of health care practitioners. Reducing feelings of isolation is hypothesized to result in longer health care practitioner retention times.

Beginning with an analysis of employment records for significant categories of health care workers in Alaska, and establishing a baseline "average length of stay" for workers in various "clustered facilities," this evaluation will begin to chart whether access to telecommunications applications and health care information will increase this "average length of stay," thereby providing cost savings and improved care. However, several problems must be addressed.

The basic problem addressed by survival analysis is that practitioners do not all begin employment at the same time. A second problem is that some (perhaps most) of the practitioners who began employment during this study may still be working at the time that

this study ends. These two problems may be solved by using methods known as survival analysis.

Survival analysis was originally developed to deal with analyzing cancer data. It has been extended to any analysis of time-to-event data where each data point has two pieces of information. One piece of information is a length of time where there is a known start date. The other piece of information is knowing whether or not there is a date for the end point or whether the end point has not yet happened, i.e., if the person is still employed at the time the study ends. If the person is still employed at the time the study ends, then their date of termination or resignation is considered to be "censored." This "censoring" is designated as "right-hand censoring" because the cut-off date is at the right hand side of the curve.

In survival analysis all data points are considered to be either a "death," that is, they have been terminated or resigned, or a "loss," that is, their termination or resignation has not yet occurred so that their resignation has been "lost" for the dataset and hence the resignation date is "censored" with the term "censored" meaning "lack of knowledge." This "censoring" will have to be modeled in the analysis and the appropriate analysis for dealing with this "right-hand censoring" is known as "survival analysis." (Anglin & Fisher, 1987; Fisher & Anglin, 1987; Kaplan & Meier, 1958)

What this analysis will provide is a median time to job loss (whether resignation or other cause). This median time is the point at which 50% of the sample have left employment. The median is used rather than the mean because the mean requires that all end points are known. In survival analysis all end points are not known.

In order to answer the question of whether telemedicine make a difference in employment retention, we will stratify the sample into those health care practitioners who have access to telemedicine infomatics versus those who did not. Separate survival curves will be considered for each stratum and the difference between these two survival curves will be tested with the Mantel log-rank test (Mantel, 1966). This analysis will be performed using PROC LIFETEST in the SAS system (SAS, 1990). If there is a significant difference between the two survival curves and the telemedicine stratum has a longer job retention than the non-telemedicine stratum, this finding, though not causal, would lend credence to the notion that access to telemedicine infomatics improves job retention of health care practitioners in Alaska. A second analysis would need to be performed to test whether feelings of isolation were also reduced in the telemedicine group.

d) A Economic Evaluation

This evaluation method is designed to assess the cost efficiency of telemedical care delivery as compared to current transportation based models. Lead evaluator Dr. Berman.

Telemedicine entails moving from a service delivery system in which patients (and often parent or guardian) physically travel from a rural area where they reside to an urban area to consult with a medical specialist, to a system in which the specialist consults with the patient and rural primary care provider using telecommunications facilities. Replacing patient transportation with electronic communications carries with it a number of important economic consequences.

An obvious issue is the potential for transportation cost savings, such as the potential for saving a portion of the $40 million spent in Alaska annually on emergency air evacuations. However, transportation cost savings may be offset by increased cost for capital and operating costs of telecommunications equipment. Other less easily quantified cost changes include the value of patients' and family members' time spent to obtain treatment, and potential changes in costs spent by health care providers.

The implications of the changing pattern of spending for health care brought by changing demographics and economics, and exemplified by telemedicine extend beyond costs for patients and health care providers. Depending on how it is financed, telemedic may affect costs and revenues of other health care recipients, businesses, and taxpayers addition, changes in the pattern of spending for health care will affect local economic activity, jobs, and earnings in both urban and rural communities.

This economic evaluation will address the economic consequences of telemedici with three interrelated economic studies. This evaluation component will perform the following: 1) a cost-benefit analysis, 2) a distribution of benefits analysis, and 3) an economic impact analysis.

Cost-Benefit Analysis

Cost-benefit analysis provides a uniform framework with which to asses the to sum of gains and losses for all members of society. We define society to include the people of Alaska. Cost-benefit analysis uses market prices to assess values when such prices are available and represent the outcome of competitive supply and demand processes. For intangible items such as the cost of patients' time spent to obtain care, benefit analysis infers dollar values where possible by observing how people trade off intangibles for items with observed market values.

The cost-benefit analysis proceeds in three steps. First, we will analyze what benefits and costs are likely to be quantifiable, based on the availability and reliability market prices and observable tradeoffs. Second, we will review which of the quantifi benefits and costs may be expressed as dollar values, based on the availability and reliability of mandated market prices and observable tradeoffs. Third, we will estimat dollar values for this subset of effects based on standard economic evaluation techniq used in the field. Potential components of the cost-benefit study, along with available valuation methods, are summarized in table 1.

Table 1. Potential Components of a Cost-Benefit Analysis

Quantifiable effects	*Source of data*	*Valuation method*
Reduced travel costs to bring rural residents to urban areas	Health care providers	Market value of spending
Increased use of existing telecommunications infrastructure between rural and urban areas	Telecommunications providers	Cost of service (marginal cost
Purchase of new telecommunications equipment	Equipment suppliers, health care providers	Market value of spending, (present discounted value)
Reduced time spent by patients, accompanying relatives to obtain care	Health care providers, patients	Travel-cost model
Reduced patient, accompanying relatives benefit of travel to urban areas	Patients	Travel-cost model
Change in health care outcomes	Outcomes evaluation, health care providers	Cost of service (marginal co

Change in satisfaction with health care outcome -- patients, health care providers	Patients	Conjoint analysis

Distribution of Benefits Analysis

The distribution analysis addresses how the financing of telemedicine is - or mor precisely, the way that the use of telemedicine changes the way that health care is finance in Alaska - changes the distribution of benefits and costs among Alaska patients, health c organizations, and governments. This analysis requires information on how the shift in technology from transportation to telecommunication changes both short term and long term revenue requirements for different types of health care, including hospitals, private and public clinics, non-profit organizations, insurance companies, and public agencies. The distribution analysis also looks at revenue requirements of transportation and telecommunications providers in Alaska. The objective is to assess who ultimately pays more - e.g., rural patients, urban patients, insurance ratepayers, telecommunications ratepayers, local, state, federal taxpayers, etc. - and who pays less after all costs are pas through the financing system.

Telecommunications differs from air travel in that fixed costs are very high relative to operating costs, and marginal costs are quite low. Estimating social costs requires actu incremental cost information. On the other hand, market values may be used to es social costs for air travel and per diem costs for transporting people.

A travel cost model needs data on trips people choose voluntarily and had to pa for. We need an estimate of the number of trips to an urban center and the cost of the We obtain an estimate of the value of the trip by observing how many fewer trips peo take from communities with higher costs. This method is extensively used by econon to value amenities that are not traded in markets such as environmental and recreationa resources (Freeman, 1991)

Use of conjoint analysis (also called contingent ranking) to estimate values is on asking survey respondents - in this case patients - to rank alternatives with differer characteristics and different costs (Mitchell & Carson, 1989)

Economic Impact Analysis

The economic impact analysis addresses how changes in the pattern of exper from telemedicine, taking into account the changes in financing methods, affects the of activity in local and regional market economies. This is basically an analysis of h spending and jobs in the rural communities, urban centers, and the state as a whole with the shift to greater use of telemedicine. For addressing economic impacts in ur areas and for the state as a whole, we will use the ISER Alaska Input-Output model has been used for a variety of applications (ISER, 1996; Tuck, 1995). For rural re we will use a regional economic base model using income multipliers to estimate in economic effects (Berman & Hull, 1987).

Three Time Horizons

The basic unit of analysis for the economic evaluation is a consultation between a patient and primary health care provider in a rural site, and a specialist who practices at an urban site. The first three years of this study will be devoted to estimating economic effects for specific types of consultations, assuming that the number and type of consultations are not affected by the provision of telemedicine. That is, the initial analysis assumes that neither the demand for health care, nor the structure of the health care industry - which people and organizations provide care - would change substantially as a result. Only the location of consultations and the technology employed would change.

During the fourth and fifth years, this analysis would have enough data and information from the other parts of the overall study to address how the broader application of telemedicine is likely to change both the demand for health care and the structure of the health care industry. For example, simple availability of e-mail or video teleconferencing may substantially increase the frequency with which primary care providers in rural areas seek consultations with specialists. At the same time, the qualifications of primary health care providers may change. Taking these effects into account may lead to different conclusions from the economic analysis as we rework the numbers.

e) An Utilization Review Analysis

This evaluation method is designed to catalogue provider utilization of various telemedical technologies. Lead evaluator Dr. Kaltenborn.

The purpose of this utilization review is to determine the effectiveness of decision making within the current transportation-based model of health care delivery and to provide the groundwork and analysis of decision making within a telecommunication-based model of health care delivery.

Utilization Review (UR) has become a key feature in analyzing and administering health care systems. This review process monitors the use of medical technology with the goal of maximizing the use of effective utilization and discouraging that which is harmful, redundant, unnecessary or unproved. This may include the decision not to hospitalize a patient, keep a patient hospitalized, or employ procedures, surgeries, or diagnostic tests on either in or out-patients. Utilization review has grown over the last decade to become a significant part of the strategy to contain medical costs and affects most Americans with health insurance.

Studies have demonstrated that UR can be effective in reducing medical costs; that it does not simply delay medical care to a later date. In order to assess fairness of medical care, it is necessary to develop and implement explicit policies and guidelines that clarify what utilization is appropriate. This may include a set of printed guidelines that are applied to an individual case and require administrative staff to collect the relevant information and to communicate with the affected parties. Often this will call for the services of a medical director (usually a MD), and administrative nurse, the collection of chart and radiology notes or reports, regular meetings and the collection of data to assess effectiveness. The affected parties include patients, their physicians or consultants and the third parties that are funding the medical care and/or use the technology. UR is effective in containing costs and assuring appropriate utilization only when all three of these groups are informed about and sympathetic with the goals of the UR process.

The implementation of UR in the evaluation of telemedicine in Alaska has several significant advantages. First, effective UR guidelines will monitor the reasons the technology is being used. If a case does not meet criterion, it will be recorded as "unapproved." Review of "unapproved" cases will lead to additional refinements of the criteria. Analyzing patient's data will lead to identification of the most appropriate utility of telemedicine. Second, UR can provide criteria that could be employed to assure

appropriate utilization of technology so that unnecessary cases do not lead to exp... of limited health care resources. Consensus building is required to establish criteria a will help to unify the parties who are providing, using, and analyzing telemedicine. I clinical medicine, UR becomes the focal point which brings together administrators, physicians, nurses, hospital workers, marketing, cost containment experts, academic medicine and the patient. This same process could apply to telemedicine and will pro key factor in its evaluation. UR can evaluate how a medical technology is being used determine whether its use is appropriate.

In order to attain the goal of establishing effective UR for telemedicine in Ala the following will be performed: 1) identify which practitioners are using telemedicir establish an electronic communication system to record which cases are being proces telemedicine technology, 3) establish an electronic system to obtain relevant clinical information to determine why the technology was used, 4) reach a consensus among practitioners by electronic communication, meetings, written and oral communicatior criteria. In addition, for the appropriate use of telemedicine this UR will 5) identify t parties to be included in the consensus process so that criteria can be revisited, 6) est an administrative process to record and analyze results of UR, 7) form a committee o experts to review cases and decide "inappropriate" uses of telemedicine, based, whe possible, on relevant medical literature and the criteria that have been established. T Utilization Review committee, chaired by Dr. Kaltenborn, will include utilization rev representatives from ANMC, Third Medical Group at Elmendorf Hospital, Providen Alaska Medical Center, and other health care facilities as they adopt telemedicine applications and technologies.

Utilization Review, often "at a distance," will ensure that telemedicine activit Alaska are not "telemedicine for the sake of technology." This review process establish guidelines for the appropriate use of telemedicine in Alaska.

4. Schedule (Phase I & II)

Phase I of this project will begin upon approval of this contract and will last six mo Phase II of the project will last for 30 months.

In quarters one and two, researchers will begin a baseline analysis of currently mai information regarding "normal" and "emergency" health care in Alaska based on transporta Researchers, faculty, and graduate students from the University of Alaska will begin to cor historically accurate picture of health care in Alaska based on five principle factors: 1) sati 2) utilization, 3) survival, 4) delivery profile, 5) cost-benefit. Each of these analytic appro will yield a baseline picture of the current transportation model of health care delivery in A

In quarters one and two the Alaska Native Health Board will choose the five regior villages that will receive equipment chosen for deployment. In quarters one and two lette agreement and equipment plan will be finalized. Equipment will be tested, deployed, and integrated in the rural health care facilities and tertiary facilities. Telecommunications syst internet, E-mail and health care infomatics systems will be tested and deployed. Training support mechanisms will be implemented.

Phase II of the project will begin in quarter three with data collection for evaluatio In quarters three through eleven data will be continuously gathered, both from partic ...rin telemedicine projects and from non-participating health care organizations. In quart ...y information will be coordinated, and analyzed. In quarter twelve a final report will be del the National Library of Medicine.

	Phase I	Q1	Additional planning;
Year 1		Q2	Evaluation baseline research Equipment decisions and purchases
	Phase II	Q3	Equipment deployment; training Evaluation data collection begins
		Q4	Equipment deployment; training Evaluation data collection continues
Year 2		Q5	Equipment deployment; training Evaluation data collection continues
		Q6	Equipment deployment ends Evaluation data collection continues
		Q7	Evaluation data collection continues
		Q8	Evaluation data collection continues
Year 3		Q9	Evaluation data collection continues
		Q10	Evaluation data collection continues
		Q11	Evaluation data analyzed
		Q12	Evaluation data analyzed Final Report

III Personnel

1. Principle Investigator/Project Director

Principle Investigator: The Principle Investigator for this grant will be Frederick W. Pearce, Ph.D. Dr. Pearce is currently the Director of the *Alaska Telemedicine Project.* Dr. Pearce is the Director of the Applied Sciences Laboratory at the University of Alaska Anchorage. He has worked on content-oriented programming in television and on-line. He is written grants and been funded by State and private agencies.

2. Other Investigators

Evaluation Director: The Evaluation Director for this grant will be Dennis G. Fisher, Ph.D. Dr. Fisher, who is currently the Director of the Center for Alcohol and Addiction Studies at the University of Alaska Anchorage, will also serve as the Co-Principle Investigator for this grant. Dr. Fisher has written and been awarded numerous grants and contracts with State and Federal agencies including NIH.

3. Additional Personnel

Time Series Analyst: The Time Series Analyst, Askar Choudhury, Ph.D., will oversee the development and implementation of the satisfaction analysis. Dr. Choudhury is a statistical specialist and has written numerous articles on time series and statistical analysis for business applications.

economic analysis of telemedicine activities in Alaska. He will use econometric models to calculate the various economic implications of telemedicine activities. Dr. Berman is a economist who has written numerous articles on econometric analysis.

Data Analyst and System Designer: The Data Analyst and System Designer, Andrea Fenaughty, Ph.D., will oversee the cluster analysis system, data collecting, and cluster grouping. She has designed systems used in drug intervention. She has written numerous articles on cluster analysis.

Utilization Review Analyst: The Utilization Review Analyst, Casey Kaltenborn, M. D., will oversee the utilization review process. He has worked in managed care environments specializing in utilization review and a utilization review process for telemedicine.

Medical Librarian: The Medical Librarian, Jerry Van Den Top, will oversee the implementation of the University of Alaska Anchorage's Medical Library data collection. She has been involved in emerging information technologies and library applications. She has worked with medical library operations.

Data Entry Supervisor: The Data Entry Supervisor, Mr. Henry Cagle, will develop, design, and program data entry procedures, maintain records, and develop data bases of collected information. He has been involved with data entry operations on several Federal grants.

Project Secretary: The project secretary, Ms. Chrintine Spence, will oversee budget and perform secretarial duties consistent with the aims of the project. She has been the project secretary on numerous Federal and State grants.

Graduate Students (TBA): The four project evaluation graduate students will help coordinate and implement the evaluation programs. They will be responsible for developing grant program contacts, evaluation questionnaires, interviews, information, and data gathering.

Appendix A

Scope of Work

The Alaska Telemedicine Project: Phase I

1.) Phase I will focus on developing a detailed plan for Phase II project implementation. The overall objective is to identify three regional hospital/health center facilities and 20 village health clinics to participate in the project. Specific activities to be undertaken which constitute a set of deliverables as Alaska Native Health Boards contribution to Phase I of the Alaska Telemedicine Project contract include:

a. Development of a methodology and criteria for site selection. Consideration will be given anticipated costs, the number of regions interested in participating, in-kind contributions at the regional level, support services availability, community size, and funding availability

b. Identify telemedecine specialists available to participate in Phase II.

c. Identify the final plan for hardware and software acquisition for all project sites.

d. Determine site setup and training requirements and develop a detailed timeline.

e. Initiate development of the required electronic data interchange interfaces.

g. As the goal of the project is the obtaining of data regarding the application of telemedicine in the State of Alaska, Alaska Native Health Board will participate with the University in the development of a plan during Phase I for the generation of data in order to ensure progress towards this end.

2.) The period of performance for Phase I is from January 1, 1997 through June 30, 1997.

3.) University of Alaska Anchorage's Contract Administrator must approve of and be included in all final discussions regarding timelines, site selection, setup, training requirements and hardware/software decisions.

4.) The University will be responsible for the purchase of all computer equipment required for this phase and all other phases of the project. For Phase I, 3 desktop and one notebook computer with an estimated value of $19,849.00 will be purchased by UAA Procurement Services for use by the Alaska Native Health Board. For inventory control purposes the equipment must be tagged with University of Alaska Anchorage property control tags. An inventory may be required as appropriate to establish possession and location of any equipment purchased.

5.) The University of Alaska will maintain ownership of any intellectual property (i.e. software, etc.) developed by or resulting from the Alaska Telemedicine Project.

6.) The communications package for the project will be First Class as the package of choice by the University's contract administrator.

7.) It is the intent of the University of Alaska Anchorage that equipment acquired by the University and installed at Native health facilities through this project remain available for use by these facilities following the conclusion of this project for the remainder of its useful life. This is subject to approval by the National Library of Medicine's contracting officer and the University of Alaska Anchorage's Contract Administrator.

8.) The payment schedule to the Alaska Native Health Board will be $30,751.00 on or about January 1st, $30,751.00 on February 28th and April 30th. The final payment of $30,751.00 will be made upon the successful completion of the contract. All payments must be approved by the UAA's Contract Administrator and are subject to approval and review by National Library of Medicine's Contracting Officer.

II Statement of Work

1. Objectives

This objective of this contract is to replicate existing and developed Alaska telemedicine testbeds by modifying, interfacing, and expanding successfully deployed narrow bandwidth telemedicine technologies and applications and to evaluate the impact of these telemedicine technologies and applications on the health care system in rural Alaska for cost, quality of care, and access to care by rural Native Alaskans where and when it is needed. Members of the *Alaska Telemedicine Project* believe that these successes can serve as models for other rural regions of the United States and for the developing nations.

This contract will build upon the organizational successes of the *Alaska Telemedicine Project* to coordinate the replication of scaled, tested approaches to telemedicine and health care infomatics in rural Alaska. Projects associated with the *Alaska Telemedicine Project* currently include Providence Health Systems in Alaska's teleradiology demonstration projects, Third Medical Group at Elmendorf Air Force Base's medical video teleconference demonstration projects, the Yukon-Kuskokwim local area network (LAN) demonstration projects, the Washington-Alaska-Montana-Idaho (WAMI) teleradiology and medical infomatics demonstration project, the Barrow video teleconferencing demonstration project, the Bartlett-Virginia Mason video teleconference project, the Alaska Native Medical Center Teleradiology Project, the Nome CHAIN project, and other examples of need-based responses to changes being imposed on health care delivery. Other projects, including Indian Health Service (IHS) Village Telemedicine Project, and the Alaska Telemedicine Infomatics Project are awaiting funding.

Each of these projects is based on responding to the needs of the community. Each is a local response to a local problem created by changes in economics and demographics. Each project requires an evaluation yet lacks the statistical expertise to evaluate the individual project within the entire context of health care delivery in Alaska. Indeed, these uncoordinated projects tend to duplicate each other given similarities based on characteristics of clientele and characteristics of technology. For these reasons, the *Alaska Telemedicine Project* has attempted to integrate these individual "players" into a consortium which can share successes and failures to demonstrate, test, and evaluate the range of applications that can be sustained in Alaska. At this time, the *Alaska Telemedicine Project* is comprised of over 40 members representing a broad spectrum of civilian, military, and Native medicine, educational institutions, and telecommunications carriers throughout the State. The *Alaska Telemedicine Project* has sponsored various telemedicine demonstration projects designed to identify and test the applicability of telemedicine in Alaska.

This contract will be executed within an environment in which the University of Alaska, and civilian, military, and Native health care organizations will develop and promote access to internet-based medical and health care bibliographic databases and electronic publications, practice guidelines, expert systems, as well as a computer-based patient records management system in selected sites in rural Alaska. Confidentiality will be maintained through the use of programs that will allow electronic health care data to be shared among selected rural Alaska villages, their regional health care "hub," and on to tertiary care facilities in Anchorage.

A goal of this contract is to provide selected health care facilities in rural Alaska with access to e-mail, dial-in, CD-ROM and internet-based health care and medical information, comprehensive medical histories, and narrow bandwidth health care and medical imaging capabilities. This project will provide rural health care practitioners with connectivity via dial-in access and internet. Isolated health care providers throughout Alaska will connect to local information servers or to information servers in Anchorage to exchange information. This e-mail system will attempt to reduce "professional isolation," the most often cited reason for the extraordinarily high turnover rate

among health care workers in rural Alaska. Information "gateways" will provide access to medical libraries, access to World Wide Web servers, and to information sites like Rural Health Care, Rural Telemedicine, Rural Mental Health Care, InterPsych, and the University of Alaska Anchorage School of Nursing and Health Sciences. In addition, this e-mail system will allow health care providers to move consultative quality medical images from rural sites to regional and urban hubs. This project will use narrow bandwidth technologies and applications to "take advantage" of Alaska's satellite-based narrow-bandwidth environment to provide access to health information. As expected improvements in internet connectivity are implemented in rural Alaska, this system will become fully internet based. Implementation, training, and support will be provided by the *Alaska Telemedicine Project* partners that include health care facilities throughout the State, the University of Alaska, and the telecommunications carriers.

This contract will apply developed and evolving evaluation methods to the *Alaska Telemedicine Project* testbed to evaluate the impact of telemedicine in a narrow bandwidth environment using five evaluation models.

2. Approach

This contract is predicated on existence of a viable consortium of Alaskan health care organizations which bring diverse experience and expertise to this project. It is based on the pioneering work performed by members of the *Alaska Telemedicine Project,* including the Norton Sound Health Corporation. It seeks to replicate the successes of the Norton Sound Community Health Aid Information Network (CHAIN) Project which uses "off-the-shelf" telecommunications and information technologies and applications to improve the quality of health care "at a distance." Scaled to rural Alaska's telecommunications infrastructure, the Norton Sound Health Corporation CHAIN Project has demonstrated the uses of narrow bandwidth technologies and applications linking 15 rural villages to the regional health care facility in Nome. The CHAIN Project has recorded 200 consultations that have resulted in improved health care to its rural villages with a significant reduction in travel cost. The proposed project is based on the narrow bandwidth characteristics of telecommunications in rural Alaska and is focused on the village and the end-user. The purpose of this project is to evaluate the impact of this project on the delivery of health care in Alaska.

This project is based on the current public switched network in Alaska and articulated plans by Alaska's telecommunications carriers to provide improved service to rural Alaska. The current telecommunications capabilities in rural Alaska are based on voice-grade circuits which are connected via satellite uplink/downlink from the rural village to one of three "toll stations" located in Anchorage, Fairbanks, and Juneau. This system, developed in the mid-1970s, requires a "double satellite hop" for voice and data from village to village (village A voice, video or data uplinked to Aurora II; downlinked to the Anchorage toll center; uplinked to Aurora II; downlinked to village B). This "double hop, with attendant transmission time delay, makes data transmission rates over 9.6 Kb difficult. In addition to voice grade circuits, AT&T Alascom's "AlaskaNet" is a X.25 network to 85 sites in rural Alaska, This network, scheduled to be upgraded to a frame relay system, allows local dial-in to an X.25 PAD and provides 9.6 Kb data transmission. General Communications, Inc. (GCI), Alaska's second long distance telecommunications carrier, has just received permission from the Alaska Public Utilities Commission to begin experimental service in rural Alaska. Both companies, which are members of the *Alaska Telemedicine Project,* are committed to providing internet-based services to rural Alaska.

Building upon the broad range of "local" telemedicine projects and current capabilities (and planned upgrades) of the public switched network, this project proposes to "take advantage" of rural Alaska's narrow bandwidth telecommunications infrastructure by building a "dial-in" and internet-based testbed for evaluating the impact of telemedicine on the health care system in selected

sites in rural Alaska for cost, quality, and access to care. This project will use AT&T Alascom's and GCI's public switched network with 1-800 dial-in, X.25, and internet capabilities to:

1. replicate and expand the Norton Sound Community Health Aid Information Network (CHAIN) testbed project by linking 25 rural villages to four selected second-level regional health care facilities and through the Alaska Native Medical Center's to other tertiary health care facilities in Anchorage by providing one of the above capabilities with selected "off-the-shelf" telecommunications and information technologies and applications; to

2. provide narrow bandwidth medical imaging capabilities for diagnosis and consultation to villages and regional "hubs" using "off-the-shelf" computers, hubs, hardware, software, digital cameras, and selected digital medical equipment; provide training and support for implementation; to

3. deliver e-mail to project participants in primary care, secondary, and tertiary care facilities by building on existing systems throughout the State;

4. provide world wide web access to bibliographic databases, electronic publications, knowledge-based information via the *Alaska Telemedicine Project* medical infomatics web server (http://telemedicine.alaska.edu) including National Library of Medicine, the University of Alaska Anchorage Medical Library ; and provide access to Anchorage-based (and internet-based) expert systems to improve the quality of diagnosis and consultation to health care providers in rural Alaska; and

5. interface the regional community health aid information network (CHAIN) "hub" database with the Indian Health Service Resource Patient Management System (RPMS) via HL7 and other international standards; to

6. provide a comprehensive history of clinical encounters on site in rural Alaska by adding community health aid encounter information to the Indian Health Service Resource Patient Management System (RPMS);

7. implement a narrow bandwidth desktop video teleconferencing service using Anchorage's local carrier, ATU Telecommunications' new ISDN service for third party consultation between the Alaska Native Medical Center (primary referral site) and secondary referral sites: The Third Medical Group at Elmendorf Air Force Base, Providence Alaska Medical Center, and the School of Nursing and Health Sciences at the University of Alaska Anchorage; to

8. improve remote diagnosis and third party consultation to rural Alaska by developing a patient records management "hub" in Anchorage at the Alaska Native Medical Center and explore sharing information from these databases with The Third Medical Group at Elmendorf Air Force Base, Providence Alaska Medical Center, and the School of Nursing and Health Sciences at the University of Alaska Anchorage for specialty consultation and referral when needed; and

9. evaluate the impact of these narrow bandwidth telemedicine applications on the health care system in Alaska for cost, quality, and access to care for rural Native Alaskans n 25 remote villages, four regional hospitals/health centers, and three tertiary medical centers, and the University of Alaska Anchorage's School of Nursing and Health Sciences and Medical Library.

Development of interfaces, equipment installation, training and support throughout the project will be provided by the major subcontractor for the project, the Alaska Native Health Board. Additional training and support will be provided by Alaska Native Medical Center, Providence Alaska Medical Center, and the University of Alaska Anchorage. This project represents a unique opportunity to integrate several on-going and planned medical and health care information projects that are already funded, with an expanded village-centered demonstration project. Together, these projects will allow health care to be delivered to a point of need to residents of some of the most remote villages in North America.

This multi-agency, multi-faceted project will combine existing telecommunications and information technologies and applications to help meet the needs of rural Alaska health care providers. It includes four sub-projects which will maximize the sharing of health care information with higher level. lower-level, and parallel providers. All sub-projects are tied together by the characteristics of Alaska's telecommunications infrastructure. These sub-projects are:

- narrow bandwidth delivery of medical and health care information via www servers and e-mail;
- low technology, narrow bandwidth telemedicine applications at three levels of care;
- electronic health data sharing at three levels of care;
- the creation of a multi-provider, multi-agency, state-wide database available to three levels of care;
- decision support software access at three levels of care.

3. Methods

The purpose of this contract is to develop and test an evaluation mechanism that can help decision makers, like regulatory and funding agencies, make difficult decisions regarding the implementation of telemedicine systems. This contract will develop a baseline of information to use as a "benchmark" for the change that the introduction of telemedicine techniques will necessarily bring about. This "baseline" research will use medical records regarding patient transfer and the cost of transportation-based health care delivery and will include a review of the State Trauma Registry; a review of the Department of Health and Social Services; a review of the Indian Health Services; and a review of the Third Medical Group records. This review process is designed to develop a baseline of information regarding the costs of health care delivery based on transportation models.

This project will use five (5) evaluation models that are designed to analyze the numerous issues relating to the development of telemedical systems in Alaska. Based on partnerships with consortia members, these evaluation models will be based on both baseline information currently compiled by various health care agencies, as well as reporting methods that will take advantage on on-site and "research-at-a-distance" techniques.

This contract will fund the following evaluation methods for 30 months in quarters three through eleven.

- decision support software access at three levels of care.

3. Methods

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This contract will fund the following evaluation methods for 30 months in quarters three through eleven.

a) A Profile Grouping of Medical Treatment Sites in Alaska

This evaluation method will use a cluster analysis techniques designed to develop group profiles on health care delivery sites. This analysis will look at the myriad of issues involved in delivering health care at a distance. Lead evaluator, Dr. Fenaughty, will focus of the following:

There are approximately 280 sites in Alaska at which medical treatment is provided. These range from tertiary-care hospitals in Anchorage, to regional facilities in Fairbanks, Kotzebue, Juneau, Bethel, Nome, etc., to primary care facilities in rural villages. The traditional method for delineating these health care facilities is based on size and medical degree of staff. The Profile Grouping and Cluster Analysis will seek to "cluster" these medical facilities using variables based on present and future telemedicine "descriptors."

The basic question posed by this Evaluation Project is: can these 280 sites be grouped into a number of sites, themselves homogeneous, while different from the other groups? Secondarily, if some of the 280 sites have some form of telemedical applications, can predictors be developed from these sites that could predict the likelihood of telemedicine application success or failure of the other sites in the same group, if and when they were also to obtain grants or moneys to begin telemedicine operations?

These questions can be answered most effectively by a cluster analysis of sites predicated on information, or descriptors, that can be used to construct profiles of each site. This cluster analysis will be performed on these site descriptor profiles. There are a number of descriptors of sites that can be used for such an analysis that have been identified and developed by members of the Telemedicine Project. These include connectivity, network support, medical hardware, technical training, infomatics systems, medical education, funding mechanism, service level and consult type.

Based on these and other "descriptors," this evaluation model will facilitate the development of construct scales (whether nominal, ordinal, or additive) for each of these

descriptor variables. The project evaluation team will obtain data from each s these "descriptors" so that each site may be scaled on each of these "descripto will constitute the profile of each site. The evaluation team will use the CLUST. (Wishart. 1987) package to perform the cluster analysis.

Replicability will be performed in two different ways. The first approac compare the agreement between two different partitions of the same dataset usin Adjusted Rand Statistic (Fisher & Hoffman. 1988; Hubert & Arabie, 1985). If robust structure to the data, then there should be a high Adjusted Rand Statistic. second approach will randomly split the sample into two subsamples. The sam analysis method will be used on each. Correlation's between mean profiles of t of the two random subsets will be compared. If there is good replicability using robust structure, then each profile in one of the subsets should have a high corre only one profile of the other subset.

In addition to replicability, the evaluation team will assess what is called (something analogous to validity). The output of the cluster analysis will be rea (SAS Institute, 1990) and groups of sites or clusters will be used as levels of th independent variable in one-way analysis of variance (ANOVAs) with occupanc acuity rate used as dependent variables. If the clusters are good predictors (i.e.. clusters are significantly different on mean occupancy rate and/or mean acuity ra variables not used as input to the cluster analysis. then the evaluation can conclu clusters are "natural" or valid in that they have predictive utility.

When the evaluation team is able to obtain clusters that are both replicab natural. these clusters will have usefulness in some of the other analyses that wi in this evaluation project.

b) A Satisfaction Analysis

This evaluation method will use an "interrupted time series techniques" designe measure primary care provider, patient, and consultant satisfaction." Lead evaluator Di Choudhory.

1) The primary objective of this type of analysis is to determine whethe telemedicine applications can increase access to "better" health care for rural Al This objective can be achieved by monitoring the number of patient visits (or fac occupancy) at the hospital or clinic over time. These results are twofold. First, be a change (possible increase) in the number of patient visits to the local health after telemedicine is introduced. Second, if telemedicine is successful, the num patient visits will consistently rise over time provided that the population size is constant.

Two different statistical time series models will be applied in analyzing t these hypotheses:

Model-I: This model will use spline function (Seber & Wild, 1989) to t hypothesis that there is a structural change after the establishment of telemedicir will require an optimization programming from an IMSL subroutine using a FO program to estimate a nonlinear "likelihood" function. A "likelihood ratio test" al., 1985) for the hypothesis of "no switching" can then be carried out.

Model II: This model will use a time series regression model to observe number of patient visits increases over time after the introduction of telemedic statistical assumptions such as autocorrelation. heteroscedasticity, etc. will b necessary correction (Choudhury, 1994, Judge et al., 1985) will be taken to obt models.

The second objective of this type of analysis is to determine if telemedicine is a satisfying experience for patients, primary and secondary care providers. This is needed to establish whether telemedicine not only provides increased access to health care delivery, but that it also improves (measured in satisfaction level) the existing health care system (or a viable alternative to the model health care delivery system). This hypothesis can be statistically analyzed by using similar time series models as referenced above.

2) A profile of psychometric properties of satisfaction indices will be developed. Because telemedicine activities affect patients, providers, and consultants, it is important to find out how each of these perspectives differs as to their satisfaction with the telemedicine experience. To capture this information, Douglas Perednia, M.D. (1995) has developed several different satisfaction scales to be used by patients, primary care providers, and consultants. These instruments must be assessed for the psychometric properties of reliability and validity.

In addition to assessing the reliability of the satisfaction scales, we will also test their validity. There are several different types of validity. The type we shall consider here is "criterion" validity. This is defined as the correlation of a scale with some other measure under study (Streiner & Norman, 1989). "Criterion" validity is divided into concurrent validity and predictive validity. Concurrent validity is the correlation of the scale with another criterion measure that is obtained at the same time as the scale score. Predictive validity is the correlation of the scale score with some criterion measure which is obtained at a later point in time than the scale score.

Validity assessment with the Perednia satisfaction scales will be predictive validity in that satisfaction scores will be used to predict later use of telemedicine applications. The hypothesis being that those individuals who have a higher satisfaction with their early telemedicine experiences will be more likely to use telemedicine in the future.

c) A Survival Analysis

This evaluation method is based on historical information and "time to event" analysis of the rate of health care provider turnover and the differences between sites that have and that do not have telemedicine. Lead evaluator Dr. Fisher.

One of the pressing and reoccurring issues of health care delivery in Alaska is how long health care practitioners stay on the job. This is an especially vexing problem in rural Alaska. Average lengths of stay of between 11 and 13 months are cited as "not unusual." The most frequently cited reason for leaving a health care delivery practice is "professional isolation," a function of physical isolation in a transportation model of health care delivery. One of the questions raised by the *Alaska Telemedicine Project* is whether having access to electronic mail (e-mail) and other communications applications provided by the Project will reduce the feeling of professional isolation of health care practitioners. Reducing feelings of isolation is hypothesized to result in longer health care practitioner retention times.

Beginning with an analysis of employment records for significant categories of health care workers in Alaska, and establishing a baseline "average length of stay" for workers in various "clustered facilities," this evaluation will begin to chart whether access to telecommunications applications and health care information will increase this "average length of stay," thereby providing cost savings and improved care. However, several problems must be addressed.

The basic problem addressed by survival analysis is that practitioners do not all begin employment at the same time. A second problem is that some (perhaps most) of the practitioners who began employment during this study may still be working at the time that

this study ends. These two problems may be solved by using methods known as survival analysis.

Survival analysis was originally developed to deal with analyzing cancer data. It has been extended to any analysis of time-to-event data where each data point has two pieces of information. One piece of information is a length of time where there is a known start date. The other piece of information is knowing whether or not there is a date for the end point or whether the end point has not yet happened, i.e., if the person is still employed at the time the study ends. If the person is still employed at the time the study ends, then their date of termination or resignation is considered to be "censored." This "censoring" is designated as "right-hand censoring" because the cut-off date is at the right hand side of the curve.

In survival analysis all data points are considered to be either a "death," that is, they have been terminated or resigned, or a "loss," that is, their termination or resignation has not yet occurred so that their resignation has been "lost" for the dataset and hence the resignation date is "censored" with the term "censored" meaning "lack of knowledge." This "censoring" will have to be modeled in the analysis and the appropriate analysis for dealing with this "right-hand censoring" is known as "survival analysis." (Anglin & Fisher, 1987; Fisher & Anglin, 1987; Kaplan & Meier, 1958)

What this analysis will provide is a median time to job loss (whether resignation or other cause). This median time is the point at which 50% of the sample have left employment. The median is used rather than the mean because the mean requires that all end points are known. In survival analysis all end points are not known.

In order to answer the question of whether telemedicine make a difference in employment retention, we will stratify the sample into those health care practitioners who have access to telemedicine infomatics versus those who did not. Separate survival curves will be considered for each stratum and the difference between these two survival curves will be tested with the Mantel log-rank test (Mantel, 1966). This analysis will be performed using PROC LIFETEST in the SAS system (SAS, 1990). If there is a significant difference between the two survival curves and the telemedicine stratum has a longer job retention than the non-telemedicine stratum, this finding, though not causal, would lend credence to the notion that access to telemedicine infomatics improves job retention of health care practitioners in Alaska. A second analysis would need to be performed to test whether feelings of isolation were also reduced in the telemedicine group.

d) A Economic Evaluation

This evaluation method is designed to assess the cost efficiency of telemedical care delivery as compared to current transportation based models. Lead evaluator Dr. Berman.

Telemedicine entails moving from a service delivery system in which patients (and often parent or guardian) physically travel from a rural area where they reside to an urban area to consult with a medical specialist, to a system in which the specialist consults with the patient and rural primary care provider using telecommunications facilities. Replacing patient transportation with electronic communications carries with it a number of important economic consequences.

An obvious issue is the potential for transportation cost savings, such as the potential for saving a portion of the $40 million spent in Alaska annually on emergency air evacuations. However, transportation cost savings may be offset by increased cost for capital and operating costs of telecommunications equipment. Other less easily quantified cost changes include the value of patients' and family members' time spent to obtain treatment, and potential changes in costs spent by health care providers.

The implications of the changing pattern of spending for health care brought changing demographics and economics, and exemplified by telemedicine extend bey costs for patients and health care providers. Depending on how it is financed, telem may affect costs and revenues of other health care recipients, businesses, and taxpa addition, changes in the pattern of spending for health care will affect local economi activity, jobs, and earnings in both urban and rural communities.

This economic evaluation will address the economic consequences of teleme with three interrelated economic studies. This evaluation component will perform t following: 1) a cost-benefit analysis, 2) a distribution of benefits analysis, and 3) a economic impact analysis.

Cost-Benefit Analysis

Cost-benefit analysis provides a uniform framework with which to asses th sum of gains and losses for all members of society. We define society to include t people of Alaska. Cost-benefit analysis uses market prices to assess values when prices are available and represent the outcome of competitive supply and demand processes. For intangible items such as the cost of patients' time spent to obtain c benefit analysis infers dollar values where possible by observing how people trade intangibles for items with observed market values.

The cost-benefit analysis proceeds in three steps. First, we will analyze w benefits and costs are likely to be quantifiable, based on the availability and reliabi market prices and observable tradeoffs. Second, we will review which of the qua benefits and costs may be expressed as dollar values, based on the availability anc reliability of mandated market prices and observable tradeoffs. Third, we will esti dollar values for this subset of effects based on standard economic evaluation tech used in the field. Potential components of the cost-benefit study, along with avail valuation methods, are summarized in table 1.

Table 1. Potential Components of a Cost-Benefit Analysis

Quantifiable effects	*Source of data*	*Valuation method*
Reduced travel costs to bring rural residents to urban areas	Health care providers	Market value of spending
Increased use of existing telecommunications infrastructure between rural and urban areas	Telecommunications providers	Cost of service (marginal
Purchase of new telecommunications equipment	Equipment suppliers, health care providers	Market value of spending (present discounted value
Reduced time spent by patients accompanying relatives to obtain care	Health care providers, patients	Travel-cost model
Reduced patient, accompanying relatives benefit of travel to urban areas	Patients	Travel-cost model
Change in health care outcomes	Outcomes evaluation, health care providers	Cost of service (marginal

Change in satisfaction with health care outcome -- patients, health care providers	Patients	Conjoint analysis

Distribution of Benefits Analysis

The distribution analysis addresses how the financing of telemedicine is - or mor precisely, the way that the use of telemedicine changes the way that health care is financ in Alaska - changes the distribution of benefits and costs among Alaska patients, health organizations, and governments. This analysis requires information on how the shift in technology from transportation to telecommunication changes both short term and long term revenue requirements for different types of health care, including hospitals, privat and public clinics, non-profit organizations, insurance companies, and public agencies. The distribution analysis also looks at revenue requirements of transportation and telecommunications providers in Alaska. The objective is to assess who ultimately pa more - e.g., rural patients, urban patients, insurance ratepayers, telecommunications ratepayers, local, state, federal taxpayers, etc. - and who pays less after all costs are p through the financing system.

Telecommunications differs from air travel in that fixed costs are very high relative to operating costs, and marginal costs are quite low. Estimating social costs requires ac incremental cost information. On the other hand, market values may be used to estim social costs for air travel and per diem costs for transporting people.

A travel cost model needs data on trips people choose voluntarily and had for. We need an estimate of the number of trips to an urban center and the cost of th We obtain an estimate of the value of the trip by observing how many fewer trips pe take from communities with higher costs. This method is extensively used by econ to value amenities that are not traded in markets such as environmental and recreatic resources (Freeman, 1991)

Use of conjoint analysis (also called contingent ranking) to estimate values on asking survey respondents - in this case patients - to rank alternatives with diffe characteristics and different costs (Mitchell & Carson, 1989)

Economic Impact Analysis

The economic impact analysis addresses how changes in the pattern of exp from telemedicine, taking into account the changes in financing methods, affects t of activity in local and regional market economies. This is basically an analysis o spending and jobs in the rural communities, urban centers, and the state as a who with the shift to greater use of telemedicine. For addressing economic impacts in areas and for the state as a whole, we will use the ISER Alaska Input-Output mo has been used for a variety of applications (ISER, 1996; Tuck, 1995). For rural we will use a regional economic base model using income multipliers to estimate economic effects (Berman & Hull, 1987).

Three Time Horizons

The basic unit of analysis for the economic evaluation is a consultation between a patient and primary health care provider in a rural site, and a specialist who practices at an urban site. The first three years of this study will be devoted to estimating economic effects for specific types of consultations, assuming that the number and type of consultations are not affected by the provision of telemedicine. That is, the initial analysis assumes that neither the demand for health care, nor the structure of the health care industry - which people and organizations provide care - would change substantially as a result. Only the location of consultations and the technology employed would change.

During the fourth and fifth years, this analysis would have enough data and information from the other parts of the overall study to address how the broader application of telemedicine is likely to change both the demand for health care and the structure of the health care industry. For example, simple availability of e-mail or video teleconferencing may substantially increase the frequency with which primary care providers in rural areas seek consultations with specialists. At the same time, the qualifications of primary health care providers may change. Taking these effects into account may lead to different conclusions from the economic analysis as we rework the numbers.

e) An Utilization Review Analysis

This evaluation method is designed to catalogue provider utilization of various telemedical technologies. Lead evaluator Dr. Kaltenborn.

The purpose of this utilization review is to determine the effectiveness of decision making within the current transportation-based model of health care delivery and to provide the groundwork and analysis of decision making within a telecommunication-based model of health care delivery.

Utilization Review (UR) has become a key feature in analyzing and administering health care systems. This review process monitors the use of medical technology with the goal of maximizing the use of effective utilization and discouraging that which is harmful, redundant, unnecessary or unproved. This may include the decision not to hospitalize a patient, keep a patient hospitalized, or employ procedures, surgeries, or diagnostic tests on either in or out-patients. Utilization review has grown over the last decade to become a significant part of the strategy to contain medical costs and affects most Americans with health insurance.

Studies have demonstrated that UR can be effective in reducing medical costs; that it does not simply delay medical care to a later date. In order to assess fairness of medical care, it is necessary to develop and implement explicit policies and guidelines that clarify what utilization is appropriate. This may include a set of printed guidelines that are applied to an individual case and require administrative staff to collect the relevant information and to communicate with the affected parties. Often this will call for the services of a medical director (usually a MD), and administrative nurse, the collection of chart and radiology notes or reports, regular meetings and the collection of data to assess effectiveness. The affected parties include patients, their physicians or consultants and the third parties that are funding the medical care and/or use the technology. UR is effective in containing costs and assuring appropriate utilization only when all three of these groups are informed about and sympathetic with the goals of the UR process.

The implementation of UR in the evaluation of telemedicine in Alaska has several significant advantages. First, effective UR guidelines will monitor the reasons the technology is being used. If a case does not meet criterion, it will be recorded as "unapproved." Review of "unapproved" cases will lead to additional refinements of the criteria. Analyzing patient's data will lead to identification of the most appropriate utility of telemedicine. Second, UR can provide criteria that could be employed to assure

appropriate utilization of technology so that unnecessary cases do not lead to exper
of limited health care resources. Consensus building is required to establish criter
will help to unify the parties who are providing, using, and analyzing telemedicine.
clinical medicine, UR becomes the focal point which brings together administrators
physicians, nurses, hospital workers, marketing, cost containment experts, academ
medicine and the patient. This same process could apply to telemedicine and will p
key factor in its evaluation. UR can evaluate how a medical technology is being us
determine whether its use is appropriate.

In order to attain the goal of establishing effective UR for telemedicine in A
the following will be performed: 1) identify which practitioners are using telemedi
establish an electronic communication system to record which cases are being proc
telemedicine technology, 3) establish an electronic system to obtain relevant clinica
information to determine why the technology was used, 4) reach a consensus amor
practitioners by electronic communication, meetings, written and oral communicati
criteria. In addition, for the appropriate use of telemedicine this UR will 5) identif
parties to be included in the consensus process so that criteria can be revisited, 6) e
an administrative process to record and analyze results of UR, 7) form a committe
experts to review cases and decide "inappropriate" uses of telemedicine, based, wi
possible, on relevant medical literature and the criteria that have been established.
Utilization Review committee, chaired by Dr. Kaltenborn, will include utilization r
representatives from ANMC, Third Medical Group at Elmendorf Hospital, Provid
Alaska Medical Center, and other health care facilities as they adopt telemedicine
applications and technologies.

Utilization Review, often "at a distance," will ensure that telemedicine acti
Alaska are not "telemedicine for the sake of technology." This review process wi
establish guidelines for the appropriate use of telemedicine in Alaska.

4. Schedule (Phase I & II)

Phase I of this project will begin upon approval of this contract and will last six r
Phase II of the project will last for 30 months.

In quarters one and two, researchers will begin a baseline analysis of currently m
information regarding "normal" and "emergency" health care in Alaska based on transpo
Researchers, faculty, and graduate students from the University of Alaska will begin to c
historically accurate picture of health care in Alaska based on five principle factors: 1) s
2) utilization, 3) survival, 4) delivery profile, 5) cost-benefit. Each of these analytic app
will yield a baseline picture of the current transportation model of health care delivery in

In quarters one and two the Alaska Native Health Board will choose the five reg
villages that will receive equipment chosen for deployment. In quarters one and two le
agreement and equipment plan will be finalized. Equipment will be tested, deployed, ar
integrated in the rural health care facilities and tertiary facilities. Telecommunications sy
internet. E-mail and health care infomatics systems will be tested and deployed. Trainir
support mechanisms will be implemented.

Phase II of the project will begin in quarter three with data collection for evaluat
In quarters three through eleven data will be continuously gathered, both from participa
telemedicine projects and from non-participating health care organizations. In quarter
information will be coordinated, and analyzed. In quarter twelve a final report will b
the National Library of Medicine.

	Phase I	Q1	Additional planning; Evaluation baseline research
Year 1		Q2	Equipment decisions and purchases
	Phase II	Q3	Equipment deployment; training Evaluation data collection begins
		Q4	Equipment deployment; training Evaluation data collection continues
Year 2		Q5	Equipment deployment; training Evaluation data collection continues
		Q6	Equipment deployment ends Evaluation data collection continues
		Q7	Evaluation data collection continues
		Q8	Evaluation data collection continues
Year 3		Q9	Evaluation data collection continues
		Q10	Evaluation data collection continues
		Q11	Evaluation data analyzed
		Q12	Evaluation data analyzed Final Report

Draft 7-28-97

National Library of Medicine
Alaska Telemedicine Testbed Project
Contract # NO1-LM-6-3540

Phase II Scope of Work
Alaska Native Health Board

This Phase II scope of work is an extension of the NLM Phase I scope of work agreement between the contractor, the University of Alaska Anchorage on behalf of the National Library of Medicine, and its subcontractor, the Alaska Native Health Board. This extension will begin on when the accompanying contract is signed (after 7/1/97) and continue until 6/30/99. As an extension of the NLM Phase I scope of work, the following principles and procedures remain in effect:

- All public references to the Project will include the title "Alaska Telemedicine Testbed Project, contract # NO1-LM-6-3540, awarded to the University of Alaska Anchorage. The Principal Investigator's name and the name of the subcontractor will appear as appropriate;

- The University of Alaska will maintain ownership of any intellectual property (i.e. software, etc.) developed by or resulting from the Alaska Telemedicine Testbed Project;

- The communications software for the Project will be FirstClass. All official communication: travel requests, travel reports, budget requests, purchase requests, weekly reports, etc. will be communicated by the subcontractor to the contractor using FirstClass messaging unless otherwise approved by the Principal Investigator. Project communication regarding this scope of work will be between the Principal Investigator and Project Manager unless otherwise approved;

- The University of Alaska Anchorage's Office of Procurement must approve all final decisions regarding contract issues including timelines, travel timelines, equipment installation timelines, training requirements, hardware and software decisions. UAA's Office of Procurement must approve disbursement of funds and cost reimbursement.

During Phase II, the Alaska Native Health Board will:

- Participate in Project equipment committee activities; participate in decision making consistent with the aims of the Project; perform rural site needs assessment and evaluation; and participate in final equipment selection adjusted to selected rural sites;

- Negotiate, on behalf of the contractor, binding operating agreements between selected rural clinics, regional hospitals, ANMC, and the University of Alaska Anchorage for purposes of implementing specific telemedicine equipment and evaluating identified clinical telemedicine events; negotiate implementation of specified Project timeline with participating rural partners; negotiate data requirements and data collection procedures for satisfaction study, "survival study" and cost-benefit evaluation of Project telemedicine events; communicate to rural partners that equipment installation is contingent upon provision of baseline data; communicate with rural partners that continued Project participation is contingent upon continuing provision of evaluation data;

- Assist in development of Project telecommunications plan;

- Participate in satisfaction study procedures development; travel to rural sites and participate in Project baseline satisfaction data implementation, training, and baseline data collection; facilitate cost and benefit data collection;

- Act as liaison between travelling evaluation personnel and participating rural site personnel for purposes of ensuring data collection by participating rural partners; help develop mechanisms and procedures for facilitating data collection throughout the Project;

- Assist the development of protocols and procedures with Project rural partners for the use of telemedicine systems, including methods to ensure confidentiality and accuracy of evaluation data;

- Install telemedicine systems in 20 villages, four regional hospitals, and ANMC;

- In conjunction with Project rural partners, establish support system for telemedicine software and hardware; establish and maintain a helpdesk for Project telemedicine systems support;

- Develop, in conjunction with any contracted support and contracted consultants, database procedures and mechanisms for storing images and data from village sites, regional hospitals, and ANMC; participate in development and deployment of communication system and development of database for evaluation data;

- Develop telemedicine training systems and curriculum for participating health care professionals;

- Train participating CHA/P's, nurses, and physicians in use of chosen telemedicine systems;

- Through continuous communication and scheduled site visits, facilitate the flow of project evaluation data from villages, regional hospitals, and ANMC to the evaluation team at the University of Alaska Anchorage;

- Maintain project inventory at rural sites, ANMC, and ANHB;

- Participate in the development of any required electronic data interchange interfaces;

- Other duties as assigned by the Principal Investigator consistent with the aims of the Project and the nature of the subcontract.

Draft 7-28-97

Alaska Telemedicine Testbed Project
Phase II Timeline

Jul. 1, 1997:	Phase I activities move to final stage Phase II scope of work negotiations begin
Jul. 15, 1997:	Phase I Final Report submitted
Aug. 1, 1997:	Phase II scope of work and contract finalized Final contract negotiations with rural partners begins Clinical review committee finalized Oversight committee established
Aug. 15, 1997:	Satisfaction study forms and procedures finalized Site travel begins for satisfaction study and negotiations
Aug. 31, 1997:	Satisfaction study site visits concluded Negotiations with rural partners finalized
Sept. 1, 1997:	Satisfaction baseline begins in region one Negotiations with telecommunications carriers Negotiations with equipment suppliers Viking training completed
Sept. 15, 1997:	Project system database issues resolved Final decision regarding clinical specialty (ies) for telemedicine encounters and evaluation
Oct.. 1, 1997:	Satisfaction baseline begins in region two
Oct. 15, 1997:	Contracts with telecommunications carriers and equipment suppliers finalized Evaluation database issues resolved
Nov. 1, 1997:	Satisfaction baseline begins in region three
Nov. 15, 1997:	PRs with telecommunications carriers and equipment suppliers processed Informatics system issues resolved
Dec. 1, 1997:	Satisfaction baseline begins in region four POs with telecommunications carriers and equipment suppliers processed
Dec. 15, 1997:	Equipment inventoried with UAA/Project bar codes Desktop video teleconferencing issues resolved Helpdesk established
Jan. 1, 1998:	Contingent on fulfillment of data collection requirements Equipment installation begins in region one

Draft 7-28-97

ANHB Contract

This contract is based on the University of Alaska Anchorage's scope of work and offered to the Alaska Native Health Board. It will cover the period from the signing of the contract (after 7/1/1997) through 6/30/1999. This contract, as stipulated by the National Library of Medicine, will be a cost-reimbursement type subcontract not to exceed $1,226,557.

Personnel

For the period of this contract, the subcontractor may maintain current personnel including the Project Manager and Telemedicine System Analyst.

The Project Manager, Mr. Robert Rawls, will interact with the Principal Investigator and act as liaison with Project rural partners. His sole point of contact for this Project will be the Principal Investigator or his disignatee. He will report to the Principal Investigator and supervise additional personnel hired "as needed" to fulfill the scope of work for the project. He will write weekly update reports communicated using FirstClass; he will write quarterly progress reports that will be tied to a reimbursement schedule beginning Oct. 1, 1997; he will use FirstClass messaging to communicate with the Principal Investigator; and oversee the subcontractor's expenditures and receipts. He will travel to Project sites and will perform training consistent with the aims of the project. He will participate in rural site data collection. He will maintain an inventory of Project equipment. He will be fully responsible for Project equipment deployed at participating rural sites. He will write a final report due on June 30, 1999. The Project Manager will be paid $62,000 per year for two years with benefits calculated at 28%.

The Telemedicine System Analyst, Dr. A. Stewart Ferguson, will oversee the integration of chosen telemedicine hardware and software with installed systems at participating rural sites and ANMC. He will develop and supervise the development of any database, software code, and patches consistent with the aims of the Project. He will oversee technical support of installed systems and act as a technical liaison with technical personnel at rural sites and any contracted support for rural systems and at ANMC. Additional technical support personnel that may be hired will report to him. The Telemedicine System Analyst will be paid $60,000 per year for two years with benefits calculated at 28%.

Additional Personnel

Additional support personnel may be hired to supplement the activities of the Project Manager and Telemedicine System Analyst. These support personnel must be justified, consistent with the Phase II scope of work, and approved by the Principal Investigator. These additional personnel may be hired to support the aims of the project and work on clinical issues, messaging and web applications and content, library support, curriculum development, training, installation of equipment, data flow monitoring, technical support, and helpdesk support as needed. These support individuals and contracted consultants will be hired on the recommendation of ANHB by the contractor and will report to the ANHB Project Manager. These support personnel will be paid on a salary scale consistent with support personnel at the University of Alaska Anchorage. Contracted consultants will be paid an hourly rate not to exceed $50 per hour.

	Clinical data collection begins in region one Cost-Benefits data collection begins in region one
Feb. 10-14, 1998:	NLM Project Officer site visit
Mar. 1, 1998:	Contingent on fulfillment of data collection requirements Equipment installation begins in region two Clinical data collection begins in region two Cost-Benefits data collection begins in region two
May 1, 1998:	Contingent on fulfillment of data collection requirements Equipment installation begins in region three Clinical data collection begins in region three Cost-Benefits data collection begins in region three
Jul. 1, 1998:	Contingent on fulfillment of data collection requirements Equipment installation begins in region four Clinical data collection begins in region four Cost-Benefits data collection begins in region four
Jul. 15, 1998:	Data collection continues Through communications and site visits, data collection assured
Jun. 30, 1999:	Contract with ANHB concludes ANHB final report Decision from NLM regarding final equipment disposition Data collection completed Final data analysis begins
Sep. 30, 1999:	Final NLM report submitted

Travel

Extensive travel will be required of Project Manager and Telemedicine Systems Analyst during this contract. These trips to participating rural sites will be fully cost reimbursed with receipts. These trips are intended to ensure that rural partners are capable of supplying information needed for satisfaction study baseline data and cost benefit analysis data collection; on-site personnel training; equipment installation; data flow monitoring and collection.

Direct Costs

Direct costs will be supplied for curriculum development, printing, copying of training materials on request. These requests will be made by FirstClass messaging system addressed to the Project Administrative Assistant. Under Federal contracting regulations only toll and long distance calls are reimbursable as direct costs.

Indirect Costs

Because of the "cost reimbursement" contract mandated by the National Library of Medicine, no indirect costs will apply to this contract other than personnel and travel. These indirect costs will be computed at 28%. No changes can be made to this rate of computing indirect costs during the contract.

Reporting

The Project Manager will submit weekly activity summaries to the Principal Investigator using FirstClass messaging. In addition, the ANHB Project Manager will submit a quarterly narrative project report providing detailed information concerning progress made on each item in the scope of work and timetable. Quarterly reports will be submitted in paper to the Principal Investigator with 15 days of the end of the quarter beginning Oct. 1, 1997.

Financial Terms

1) This agreement is for the period 7/1/97 through 6/30/99 is a cost reimbursement contract for a total of $470,346.24. This total is based on Project personnel and travel through 6/30/99. This figure does not include funding for consultants, telecommunications, or equipment. Indirect will be calculated on this figure for the Project.

2) Current authorized spending limit from 7/1/97 through 11/30/97 is 55,447.80. This includes salary, fringe benefits, travel of $8,473. Travel until Nov. 30 (NLM mandated budget renewal date) will be limited Project Manager traveling to four regional centers. Indirect on these items calculated at 28%.

3) ANHB will invoice UAA at the end of each quarter for expenditures incurred consistent with the scope of work. Invoice will specify expenditures by budget category (salaries, fringe benefits, travel).

4) UAA will reimburse ANHB within 30 days of receipt of invoice.

5) ANHB will provide UAA with an original copy of audited financial statements for each fiscal year covered by the agreement.

Equipment acquisition and management

UAA will be responsible for the purchase of all sensitive equipment required for the project as defined NLM. UAA Procurement Services will acquire equipment for the project testbed sites. For inventory control purposes, the equipment will be tagged with special UAA/ANHB "Alaska Telemedicine Testbed Project" property control tags. An inventory may be required as appropriate to establish possession and location of any equipment provided. ANHB will be responsible for all equipment deployed to rural sites and the Project Manager will maintain an inventory of this equipment.

Subject to the approval of the NLM, all equipment acquired by UAA and installed by ANHB at rural facilities will remain available for use by these facilities following the conclusion of the Project (6/30/99) for the remainder of its useful life of this equipment.

Appendix A

Scope of Work

The Alaska Telemedicine Project: Phase I

1.) Phase I will focus on developing a detailed plan for Phase II project implementation. The overall objective is to identify three regional hospital/health center facilities and 20 village health clinics to participate in the project. Specific activities to be undertaken which constitute a set of deliverables as Alaska Native Health Boards contribution to Phase I of the Alaska Telemedicine Project contract include:

a. Development of a methodology and criteria for site selection. Consideration will be given anticipated costs, the number of regions interested in participating, in-kind contributions at the regional level, support services availability, community size, and funding availability

b. Identify telemedecine specialists available to participate in Phase II.

c. Identify the final plan for hardware and software acquisition for all project sites.

d. Determine site setup and training requirements and develop a detailed timeline.

e. Initiate development of the required electronic data interchange interfaces.

g. As the goal of the project is the obtaining of data regarding the application of telemedicine in the State of Alaska, Alaska Native Health Board will participate with the University in the development of a plan during Phase I for the generation of data in order to ensure progress towards this end.

2.) The period of performance for Phase I is from January 1, 1997 through June 30, 1997.

3.) University of Alaska Anchorage's Contract Administrator must approve of and be included in all final discussions regarding timelines, site selection, setup, training requirements and hardware/software decisions.

4.) The University will be responsible for the purchase of all computer equipment required for this phase and all other phases of the project. For Phase I, 3 desktop and one notebook computer with an estimated value of $19,849.00 will be purchased by UAA Procurement Services for use by the Alaska Native Health Board. For inventory control purposes the equipment must be tagged with University of Alaska Anchorage property control tags. An inventory may be required as appropriate to establish possession and location of any equipment purchased.

5.) The University of Alaska will maintain ownership of any intellectual property (i.e. software, etc.) developed by or resulting from the Alaska Telemedicine Project.

6.) The communications package for the project will be First Class as the package of choice by the University's contract administrator.

7.) It is the intent of the University of Alaska Anchorage that equipment acquired by the University and installed at Native health facilities through this project remain available for use by these facilities following the conclusion of this project for the remainder of its useful life. This is subject to approval by the National Library of Medicine's contracting officer and the University of Alaska Anchorage's Contract Administrator.

8.) The payment schedule to the Alaska Native Health Board will be $30,751.00 on or about January 1st, $30,751.00 on February 28th and April 30th. The final payment of $30,751.00 will be made upon the successful completion of the contract. All payments must be approved by the UAA's Contract Administrator and are subject to approval and review by National Library of Medicine's Contracting Officer.

Appendix A

National Library of Medicine

Alaska Telemedicine Testbed Project

Contract #N01-LM-6-3540

Phase II Scope of Work
Alaska Native Health Board

This Phase II scope of work is a continuation of the NLM Phase I scope of work agreement between the University of Alaska Anchorage (hereafter referred to as the Contractor) on behalf of the National Library of Medicine, and the Alaska Native Health Board (hereafter referred to as the Subcontractor). This continuation will begin on 7/1/97 and end 6/30/99. As a continuation of the NLM Phase I scope of work, the following principles and procedures remain in effect:

A. The Alaska Telemedicine Testbed Project is built on a collaboration between the University of Alaska Anchorage and Alaska Native health organizations such as ANHB and the Indian Health Service. This collaborative decision making process will continue for key issues in Phase II of the project. The project will at all times respect the rights and interests of the Alaska Native patients, organizations and health professionals who will be participating in the evaluation study.
B. All public references to the Project will include the title "Alaska Telemedicine Testbed Project, contract #N01-LM-6-3540, awarded to the University of Alaska, Anchorage." The Principal Investigators name and the name of the Subcontractor will appear as appropriate;
C. The Contractor will maintain ownership of any intellectual property (i.e. software, etc.) developed by or directly resulting from the Alaska Telemedicine Testbed Project;
D. The communications software for the project will be First Class. All official communication: equipment and purchase requests, budget requests, travel requests, requests for re-imbursements, weekly update reports, etc. will be communicated by the Subcontractor to the Contractor using FirstClass messaging unless otherwise approved by the Principal Investigator. Project communication regarding this scope of work will be between the Principal Investigator and the Project Manager unless otherwise approved;
E. The Principal Investigator, on behalf of NLM, will participate in negotiations and finalize all agreements and contracts between Project and hardware and software vendors and telecommunications vendors. The Contractor's Office of Procurement must approve all purchases. Requests for disbursement of funds and cost re-imbursement will be based on the Contractor's reporting procedures. Purchases over $1,000 or if the item is considered critical, must be approved by the Contract Officer at the National Library of Medicine.

During Phase II, the Subcontractor will:

F. Facilitate and participate in Project Equipment Committee activities; participate in decision making consistent with the aims of the Project; perform rural site hardware and software needs assessment and evaluation; participate in final hardware and software systems and equipment selection adjusted to selected rural sites; develop final plan and implementation timeline for Project telemedicine systems;
G. Negotiate, on behalf of the Contractor, binding operating agreements between selected rural clinics, regional hospitals and ANMC for purposes of implementing specific telemedicine systems and evaluating identified clinical telemedicine events; negotiate implementation of specified Project timeline with participating rural partners; facilitate data requirements and data collection procedures for satisfaction study, "survival study" and cost-benefit evaluation of Project telemedicine events; communicate to rural partners that equipment installation is contingent upon provision of baseline data; communicate with rural partners that continued Project participation is contingent upon continuing provision of evaluation data; communicate to rural partners that they are responsible for Project equipment provided to their facilities. This activity pending the receipt of detailed evaluation plan from the Contractor;
H. Act as a liaison between evaluation personnel and participating rural site personnel for purposes of ensuring data collection by participating rural partners; through regular communication, facilitate the flow of project evaluation data from villages, regional hospitals and ANMC to the evaluation team at the University of Alaska Anchorage; help develop mechanisms and procedures for facilitating data collection throughout the Project;
I. Assist in the development of protocols and procedures with Project rural partners for the use of telemedicine systems, including methods to ensure confidentiality and accuracy of evaluation data;
J. Install telemedicine systems in 20 villages, four regional hospitals and ANMC;
K. In conjunction with Project partners, establish support system for telemedicine software and hardware; establish and maintain an effective support system for Project telemedicine systems;
L. Develop telemedicine training systems and curriculum for participating health care professionals;
M. In conjunction with project partners, coordinate training for participating CHA/P's, nurses and physicians in use of chosen telemedicine systems;

Addtional Personnel

N. Additional support personnel may be hired by the Subcontractor to supplement Project activities. These support personnel must be justified, consistent with the Phase II scope of work, and approved by the Principal Investigator.

Additional Personnel (cont.)

These additional personnel may be hired to support the aims of the project and work on clinical issues, curriculum development, training, installation of equipment, data flow monitoring, technical support and helpdesk support as needed. Based on additional consultant budget of $30,000, negotiate any necessary consultant agreements.

Travel

O. Extensive travel will be required of Subcontractor during this contract. These trips to participating rural sites will be fully cost reimbursed with receipts. These trips will support site evaluation, installation and maintenance of selected telemedicine equipment; and Project staff training. These trips are intended to ensure that rural partners are capable of supplying information needed for satisfaction study baseline data and cost benefit analysis data collection; on-site personnel training; data flow monitoring and collection. Develop final travel plans based on travel budget of $77,061. Negotiate agreements with travel vendors.

Activity Approval Process

P. Within 15 days of the beginning of each quarter, the Subcontractor will submit, via electronic mail, a proposed schedule of activities for the coming quarter including the following:

1. Anticipated travel by ANHB project staff and consultants during the upcoming quarter, with detail concerning dates of travel, location, designated traveller, purpose of travel and estimated cost.
2. Consultant agreements anticipated during the upcoming quarter, with detail concerning scope of consultant work, name of consultant or firm, consultant qualifications statement, period of performance, rate and estimated cost.
3. Hardware and software acquisitions anticipated during the upcoming quarter as recommended by the Equipment Committee, with detail concerning hardware/software specifications, location of installation and estimated cost.
4. Telecommunications support agreements anticipated during the upcoming quarter with detail concerning vendor(s), type of service and estimated cost.
5. Anticipated training costs for the upcoming quarter with detail concerning workshops, training materials, curriculum development, printing and software.
6. Anticipated direct costs for the upcoming quarter such as phone, teleconferences, office supplies, printing, software and communications aids.

The Principal Investigator will review the activity schedule and provide Subcontractor with a response by the beginning of each quarter, with justification for any non-approved item. The Subcontractor has the right to appeal non-approved items. The Subcontractor will make expenditures based on this quarterly activity approval process.

Activity Approval Process (cont.)

Should ANHB require a variance from the approved expenditure plan, notice of variance will be provided to the Principal Investigator, who will provide an indication of approval or non-approval within 5 working days.

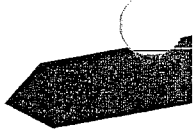
Project Reporting

Q. The Subcontractor will submit weekly activity summaries to the Principal Investigator by electronic mail. In addition, the Subcontractor will submit quarterly narrative project reports providing detailed information concerning progress made on each item in the scope of work. Quarterly reports will be submitted on paper to the Principal Investigator within 15 days of the end of the quarter, beginning October 1, 1997.

Equipment Acquisition and Management:

R. The Contractor will be responsible for the purchase of all sensitive equipment required for the Project as defined by NLM. UAA Procurement Services will acquire equipment for the Subcontractor testbed project sites. The Contractor reserves funds in the amount of $317,822 for this purpose. For inventory control purposes the equipment will be tagged with UAA property control tags. An inventory may be required as appropriate to establish possession and location of any equipment provided. The Subcontractor will maintain an inventory of this equipment.

S. Subject to the approval by the NLM Contracting Officer, all equipment acquired by the Contractor and installed at rural facilities through this project will remain available for use by these facilities following the conclusion of this project for the remainder of its useful life.



Telecommunications Costs

T. The Contractor agrees to collaborate closely with the Subcontractor during telecommunications planning and negotiation. The Contractor agrees to ensure that telecommunications service will be provided to all testbed sites throughout Phase II. The Contractor reserves funds in the amount of $112,640 for this purpose. The Contractor agrees to negotiate re-allocation of any savings from this account to support Subcontractor testbed activities.

Financial Terms

U. The budgeted costs should be used solely as a guide for establishing a budget proposal; only actual costs shall be subsequently charged to the Contractor. The Subcontractor shall use its best efforts to perform within the estimated costs listed in the budget. Budget revisions for variances between line items may be requested by the Subcontractor.

Financial Terms (cont.)

V. Payments under this contract shall be made on a cost-reimburseable basis. The Contractor shall reimburse the Subcontractor for the Alaska Telemedicine Testbed Project not to exceed the total of $ 750,089 for the life of the project. The Subcontractor shall submit monthly itemized invoices to the Contractor on or before the 30th of the following month. Billings shall only include charges already incurred the month billed; no prepayment shall be made foe services that have not been rendered.

W. Invoice detail shall include the actual amount paid in direct labor expenses (including benefits) for services performed solely on this project. Other allowable reimbursable expenses, including indirect costs, will be only those costs associated with service provided to the Alaska Telemedicine Testbed Project during the previous monthly period. Upon approval of invoices by the Contractor's Principal Investigator, reimbursement shall be made within 30 days of receipt of Subcontractor invoice.

X. The Subcontractor will provide the Contractor with an original copy of audited financial statements for each fiscal year covered by this agreement.

Y. Subcontractor indirect cost reimbursement shall be made at the final federally approved indirect cost rate in effect as of the date of award of the NLM contract to the University of Alaska, Anchorage.

		Alaska Telemedicine Testbed Project						
		NLM Contract N01-LM-6-3540						
		Phase II Subcontractor Budget - 7/1/97-6/30/99						
		Alaska Native Health Board						
UAA Code	ANHB Code	Category	Rate	Salary	FY97	FY98	FY99	Total
1001		**Salaries**						
	42-00-503	Project Director	34.06	62,000	15,497	61,989	46,491	123,977
*	506	Systems Analyst	32.97	60,000	15,001	60,005	45,004	120,010
	504	Computer Specialist/Trainer	27.47	50,000		50,000	37,500	87,500
		Sub-Total			30,498	171,994	128,995	331,487
	211-216	Fringe @ 25%			7,625	42,999	32,249	82,872
		(FICA, Wcomp, Health, Life, STD, ESC, TSA, P/L)						
		Total Salaries			38,123	214,993	161,244	414,359
3001	520	**Contractual Services**						32,500
		Consultants - Development			3,000	5,000	2,000	
		Consultants - Training				18,500		
		Consultants - Clinical				4,000		
	520	Training CD-ROM	150 hours	50		7,500		
2001	543 -544	**Travel (airfare, perdiem)**						85,068
		Travel - ANHB Staff				58,948	18,120	
		Travel - Train the Trainers				8,000		
3442	535	**Telephone Toll Costs**						12,000
		Training Phone and Teleconferences				2,000	2,000	
		Development Phone and Teleconferences				1,000	1,000	
		Partner Agreements Phone				1,000	1,000	
		Eval Follow-up Phone				1,000	3,000	
4010	538	**Office Supplies**			950	950	950	2,850
4014	529	**Computer Supplies**				1,100	1,100	2,200
3444	537	**Postage**				800	800	1,600
3331	536	**Duplication Charges (inc. printing)**				2,500	500	3,000
* 3007	529	**Training/Program Supplies**				1,000		
4441	528	**Other/Misc. Expenses**				950	950	1,900
		SUB-TOTAL			42,073	329,241	192,664	563,977
		ANHB Indirect @ 33%			13,884	108,649	63,579	186,112
		TOTAL PHASE II OPERATING			55,956	437,890	256,243	750,089
		Phase II Funding (ANHB)						*750,089*
		Phase I Funding (ANHB)						*123,004*
		Phase I Equipment (ANHB)						*19,849*
		TOTAL (ANHB)						*892,942*

Lodging 40,000

1.53

DEPARTMENT OF HEALTH & HUMAN SERVICES

Public Health Service

National Institutes of Health
National Library of Medicine
Bethesda MD 20894

February 3, 1998

Bob Kizer, C.P.M.
University of Alaska Anchorage
Procurement Services Department
3211 Providence Drive
Anchorage, AK 99508

Subject: Contract No. NO1-LM-6-3540, Contracting Officer Authorization (COA) No. 7

Dear Mr. Kizer:

In response to the University of Alaska's request of January 30, 1998, COA No. is deleted in its entirety, therefore, authorization to purchase the following equipment is rescinded:

AUTHORIZATION RESCINDED FOR:

Item	Manufacturer	Description	Unit Price	Qty
7	MedVision, Inc.	VisiTran-MD V 1.7 video imaging software With extended warranty plan	$1,875	30
8	MedVision, Inc.	VisiTran MD 1.7 View	$1,000	10
Total Value			$66,250	

and authorization is granted to purchase the following equipment:

AUTHORIZATION GRANTED FOR:

Item	Manufacturer	Description	Unit Price	Qty
7	MedVision, Inc.	VisiTran-MD V 1.7 video imaging software With extended warranty plan	$1,732	40
Total Value			$66,280	

Title to this equipment shall vest in the Contractor upon acquisition. The equipment must be reported on an annual basis and at contract completion using the enclosed form HHS-565, Report of Capitalized Nonexpendable Equipment. Please submit the form to the NIH Property Administrator, Building 13, Room 2E65, Bethesda, MD 20892-5748. In addition, form HHS-565 must be submitted with the corresponding invoice when billing for these items. **COA No. 7** shall be cited when billing for these items.

The total amount of each item, including tax, shipping and installation, may not exceed 10% of the amount specified above without written authorization from the Contracting Officer. Sales tax,

DEPARTMENT OF HEALTH & HUMAN SERVICES

Public Health Service

National Institutes of Health
National Library of Medicine
Bethesda MD 20894

February 13, 1998

Bob Kizer, C.P.M.
University of Alaska Anchorage
Procurement Services Department
3211 Providence Drive
Anchorage, AK 99508

Subject: Contract No. NO1-LM-6-3540, Contracting Officer Authorization (COA) No. 8

Dear Mr. Kizer:

In response to the University of Alaska's request of February 6, 1998, authorization is granted to use contract funds to purchase the following capitalized nonexpendable equipment items in the amounts stated:

Item	Manufacturer	Description	Unit Price	Qty	Extended Price
9.	Dell	Poweredge 2200-128-18.0GB-15SVGA server system	$5,871	2	$11,742

Title to this equipment shall vest in the Contractor upon acquisition. The equipment must be reported on an annual basis and at contract completion using the enclosed form HHS-565, Report of Capitalized Nonexpendable Equipment. Please submit the form to the NIH Property Administrator, Building 13, Room 2E65, Bethesda, MD 20892-5748. In addition, form HHS-565 must be submitted with the corresponding invoice when billing for these items. **COA No. 8** shall be cited when billing for these items.

The total amount of each item, including tax, shipping and installation, may not exceed 10% of the amount specified above without written authorization from the Contracting Officer. Sales tax, shipping and installation charges are allowable expenses but must be listed separately on the form HHS-565.

Capitalized Nonexpendable Equipment must be accounted for and maintained in accordance with the Contractor's Guide for Control of Government Property. The Guide is available from the NIH Property Administrator.

DEPARTMENT OF HEALTH & HUMAN SERVICES

Public Health Service

National Institutes of Health
National Library of Medicine
Bethesda MD 20894

March 19, 1998

Bob Kizer, C.P.M.
University of Alaska Anchorage
Procurement Services Department
3211 Providence Drive
Anchorage, AK 99508

Subject: Contract No. NO1-LM-6-3540, Contracting Officer Authorization (COA) No. 9R

Dear Mr. Kizer:

In response to the University of Alaska's request of March 13, 1998, Contracting Officer Authorization No. 9 is amended to increase the quantity from 1 to 2 and shall read as follows:

Authorization is granted to use contract funds to purchase the following capitalized nonexpendable equipment items in the amounts stated:

Item	Manufacturer	Description	Unit Price	Qty	Extended Price
10.	Microsoft	Backoffice Server Software 4.0 with 30 workstation licences	$1,124	2	$2,248

Title to this equipment shall vest in the Contractor upon acquisition. The equipment must be reported on an annual basis and at contract completion using the enclosed form HHS-565, Report of Capitalized Nonexpendable Equipment. Please submit the form to the NIH Property Administrator, Building 13, Room 2E65, Bethesda, MD 20892-5748. In addition, form HHS-565 must be submitted with the corresponding invoice when billing for these items. **COA No. 9R** shall be cited when billing for these items.

The total amount of each item, including tax, shipping and installation, may not exceed 10% of the amount specified above without written authorization from the Contracting Officer. Sales tax, shipping and installation charges are allowable expenses but must be listed separately on the form HHS-565.

Capitalized Nonexpendable Equipment must be accounted for and maintained in accordance with the Contractor's Guide for Control of Government Property. The Guide is available from the NIH Property Administrator.

DEPARTMENT OF HEALTH & HUMAN SERVICES

Public Health Service

National Institutes of Health
National Library of Medicine
Bethesda MD 20894

March 19, 1998

Bob Kizer, C.P.M.
University of Alaska Anchorage
Procurement Services Department
3211 Providence Drive
Anchorage, AK 99508

Subject: Contract No. NO1-LM-6-3540, Contracting Officer Authorization (COA) No. 10

Dear Mr. Kizer:

In response to the University of Alaska's request of March 12, 1998, authorization is granted to use contract funds to purchase the following capitalized nonexpendable equipment items in the amounts stated:

Item	Manufacturer	Description	Unit Price	Qty	Extended Price
11.	Gateway	Processor: Intel 233MHz Pentium II Processor w/ 512K Cache Memory: 64MB SDRAM Monitor: EV700 17" color monitor Graphics Accelerator: nVidia 4MB AGP Video Card Hard Drive: 4.0GB Ultra ATA hard drive Floppy Drive: 3.5" 1.44MB diskette drive CD-ROM: 13X min./32X max. CD-ROM drive Multimedia Package: Ensoniq wavetable sound card & Altec ACS-41 speakers Case: GP-Series Mid Tower Network Card: 3COM PCI 10/100 twisted pair Ethernet Keyboard: 104+ Keyboard Mouse: MS IntelliPoint Mouse; Gateway mouse pad Additional Software: McAfee Anti Virus Software Application Software: MS Office 97, Small Business Edition, on CD w/Bookshelf Operating System: Microsoft Windows 95 Service Program: Gateway GoldTM Service and Support (1yr. Onsite)	$2,170	8	$17,360
12.	DEC	4.3GB SCSCI Drive	$1,135	1	$1,135

Title to this equipment shall vest in the Contractor upon acquisition. The equipment must be reported on an annual basis and at contract completion using the enclosed form HHS-565, Report of Capitalized Nonexpendable Equipment. Please submit the form to the NIH Property Administrator, Building 13, Room 2E65, Bethesda, MD 20892-5748. In addition, form HHS-565 must be submitted

DEPARTMENT OF HEALTH & HUMAN SERVICES

Public Health Service

National Institutes of Health
National Library of Medicine
Bethesda MD 20894

May 7, 1998

Bob Kizer, C.P.M.
University of Alaska Anchorage
Procurement Services Department
3211 Providence Drive
Anchorage, AK 99508

Subject: Contract No. NO1-LM-6-3540, Contracting Officer Authorization (COA) No. 11

Dear Mr. Kizer:

In response to the University of Alaska's request of May 5, 1998, authorization is granted to use contract funds to purchase the following capitalized nonexpendable equipment items in the amounts stated:

Item	Manufacturer	Description	Unit Price	Qty
13.		Viking Data Entry System Software Version 4.0 license	$1,150	1

Title to this equipment shall vest in the Contractor upon acquisition. The equipment must be reported on an annual basis and at contract completion using the enclosed form HHS-565, Report of Capitalized Nonexpendable Equipment. Please submit the form to the NIH Property Administrator, Building 13, Room 2E65, Bethesda, MD 20892-5748. In addition, form HHS-565 must be submitted with the corresponding invoice when billing for these items. **COA No. 11** shall be cited when billing for these items.

The total amount of each item, including tax, shipping and installation, may not exceed 10% of the amount specified above without written authorization from the Contracting Officer. Sales tax, shipping and installation charges are allowable expenses but must be listed separately on the form HHS-565. Capitalized Nonexpendable Equipment must be accounted for and maintained in accordance with the Contractor's Guide for Control of Government Property. The Guide is available from the NIH Property Administrator.

This authorization does not amend any other terms or conditions of the contract and is subject to the availability of existing contract funds. Should you have any questions, please contact me by phone on 301-496-6546 or by email at mary_adamik@nih.gov.

Sincerely,

Mary V. Adamik
Contracting Officer
Office of Acquisitions Management
National Library of Medicine

Enclosure

1.58

DEPARTMENT OF HEALTH & HUMAN SERVICES

Public Health Service

National Institutes of Health
National Library of Medicine
Bethesda MD 20894

July 10, 1998

Bob Kizer, C.P.M.
University of Alaska Anchorage
Procurement Services Department
3211 Providence Drive
Anchorage, AK 99508

Subject: Contract No. NO1-LM-6-3540, Contracting Officer Authorization (COA) No. 12

Dear Mr. Kizer:

In response to the University of Alaska's request of June 12, 1998, authorization is granted to use contract funds to purchase the following capitalized nonexpendable equipment items in the amounts stated:

Item	Manufacturer	Description	Unit Price	Qty
14.	Micron	ATCX.MINI TOWER.XKU INTEL PENTIUM II.300MHZ PROCESSOR 128MB.16X64.SDRAM DIMM 512K INTERNAL L2.SECONDARY CACHE 8.4GB.ATA 33.HDD 32-BIT LOCAL BUS ULTRA ATA.HARD DRIVE CONTROLLER 3.5 FLOPPY.W/ZIP.MINITOWER DVD II PAK DIAMOND.VIPER 330.66MHZ AGP CARD 17 INCH.(16.0 VIEWABLE).26 DP MONITOR 104 KEY ENHANCED PS2 KEYBOARD MS.INTELLIMOUSE.(ENGLISH).KIT MS.HOME ESSENTIALS/POWER PAK YAMAHA WAVETABLE.W/STANDARD SPEAKERS 3COM.US ROBOTICS.56K.V.90/X2.DATA/FAX.WINMODEM STANDARD SPEAKERS 3COM.3C905.10/100.NETWORK CARD WINDOWS 98 ON CD NO MICRON.SOFTWARE SOLUTION PK 1ST YR.(USA ONLY) OPT.ON-SITE	$2,580	1

Title to this equipment shall vest in the Contractor upon acquisition. The equipment must be reported on an annual basis and at contract completion using the enclosed form HHS-565, Report of Capitalized Nonexpendable Equipment. Please submit the form to the NIH Property Administrator, Building 13, Room 2E65, Bethesda, MD 20892-5748. In addition, form HHS-565 must be submitted with the corresponding invoice when billing for these items. **COA No. 12** shall be cited when billing for these items.

The total amount of each item, including tax, shipping and installation, may not exceed 10% of the amount specified above without written authorization from the Contracting Officer. Sales tax, shipping and installation charges are allowable expenses but must be listed separately on the form HHS-565. Capitalized Nonexpendable Equipment must be accounted for and maintained

DEPARTMENT OF HEALTH & HUMAN SERVICES

Public Health Service

National Institutes of Health
National Library of Medicine
Bethesda MD 20894

July 17, 1998

Bob Kizer, C.P.M.
University of Alaska Anchorage
Procurement Services Department
3211 Providence Drive
Anchorage, AK 99508

Subject: Contract No. NO1-LM-6-3540, Contracting Officer Authorization (COA) No. 13

Dear Mr. Kizer:

In response to the University of Alaska's request of June 15, 1998, authorization is granted to use contract funds to purchase the following capitalized nonexpendable equipment items in the amounts stated:

Item	Manufacturer	Description	Unit Price	Qty
15		First Class Server Software license	$1,599.00	1

Title to this equipment shall vest in the Contractor upon acquisition. The equipment must be reported on an annual basis and at contract completion using the enclosed form HHS-565, Report of Capitalized Nonexpendable Equipment. Please submit the form to the NIH Property Administrator, Building 13, Room 2E65, Bethesda, MD 20892-5748. In addition, form HHS-565 must be submitted with the corresponding invoice when billing for these items. **COA No. 13** shall be cited when billing for these items.

The total amount of each item, including tax, shipping and installation, may not exceed 10% of the amount specified above without written authorization from the Contracting Officer. Sales tax, shipping and installation charges are allowable expenses but must be listed separately on the form HHS-565. Capitalized Nonexpendable Equipment must be accounted for and maintained in accordance with the Contractor's Guide for Control of Government Property. The Guide is available from the NIH Property Administrator.

This authorization does not amend any other terms or conditions of the contract and is subject to the availability of existing contract funds. Should you have any questions, please contact me by phone on 301-496-6546 or by email at mary_adamik@nih.gov.

Sincerely,

Mary V. Adamik
Contracting Officer
Office of Acquisitions Management
National Library of Medicine

Enclosure

1.60

DEPARTMENT OF HEALTH & HUMAN SERVICES

Public Health Service

National Institutes of Health
National Library of Medicine
Bethesda MD 20894

March 25, 1999

Robert Kizer, C.P.M.
University of Alaska Anchorage
Procurement Services Department
3211 Providence Drive
Anchorage, AK 99508

Subject: Contract No. NO1-LM-6-3540, Contracting Officer Authorization (COA) No. 14

Dear Mr. Kizer:

In response to the University of Alaska's request of March 8, 1999, authorization is granted to use contract funds to purchase the following capitalized nonexpendable equipment items in the amounts stated:

Item	Manufacturer	Description	Unit Price	Qty	Total Price
16	Micron	ClientPro CS, 350MHz, 96MB, 8.4GB, 17" monitor	$1,710	12	$20,520
17	Dell	Dimension XPS-R, 400MHz, 96MB, 8.4GB, 17" monitor	$1,898	6	$11,388
Total					$31,908

Title to this equipment shall vest in the Contractor upon acquisition. The equipment must be reported on an annual basis and at contract completion using the enclosed form HHS-565, Report of Capitalized Nonexpendable Equipment. Please submit the form to the NIH Property Administrator, Building 13, Room 2E65, Bethesda, MD 20892-5748. In addition, form HHS-565 must be submitted with the corresponding invoice when billing for these items. **COA No. 14** shall be cited when billing for these items.

The total amount of each item, including tax, shipping and installation, may not exceed 10% of the amount specified above without written authorization from the Contracting Officer. Sales tax, shipping and installation charges are allowable expenses but must be listed separately on the form HHS-565. Capitalized Nonexpendable Equipment must be accounted for and maintained in accordance with the Contractor's Guide for Control of Government Property. The Guide is available from the NIH Property Administrator.

1.61

National Library of Medicine
Alaska Telemedicine Testbed Project
Contract #N01-LM-6-3540

Joint Operating Agreement

University of Alaska, Anchorage
Alaska Native Health Board
Maniilaq Association

Background

The National Library of Medicine has awarded the Applied Sciences Laboratory of the University of Alaska Anchorage (UAA) a contract to evaluate the effect of narrow bandwidth telemedicine and telehealth applications and technologies on the delivery of health care to rural Alaska. Specifically, the Alaska Telemedicine Testbed Project (ATTP) will study the impacts that the introduction of telemedicine technology will have on 1) the satisfaction of patients and health care providers with telemedicine technology; 2) the "professional isolation" of some rural health care professionals, and 3) the cost and benefit of using telemedicine to deliver health care to rural Alaska. The ATTP partners believe that the success of this project will help participating rural partners develop a business plan for the further implementation of cost efficient and clinically effective telemedicine and telehealth applications.

The University of Alaska Anchorage has contracted with the Alaska Native Health Board to 1) participate in the design and implementation of store and forward telemedicine systems and 2) liaison with participating rural health care organizations in the collection of project data. Through a state-wide selection process in March, 1997, Maniilaq Association has been chosen as a partner in the Alaska Telemedicine Testbed Project. The Maniilaq Health Center and the health clinics in Kobuk, Shungnak, Ambler, Noorvik, Kiana, Selawik, Buckland, Deering, Kivalina and Noatak have been chosen as the participating facilities. The staff at these facilities will be the research adjuncts for the ATTP, and will participate in the collection of project data.

Project partners UAA and ANHB have selected ear infection and ear disease as the primary clinical application for the ATTP evaluation study. The project is funded through September 30, 1999. UAA will publish the results of this evaluation at the end of project in hopes of advancing knowledge in the emerging discipline of telemedicine and telehealth. The results of data collected from this project can be used by Maniilaq Association to chart a technology future for rural medicine in Alaska.

The following joint operating agreement language outlines the responsibilities of each partner in carrying this telemedicine research project forward.

Period of Agreement
Section I

Subject to approval by the National Library of Medicine, this agreement shall commence upon signing and shall terminate on June 30, 1999. The parties upon mutual consent may extend or amend this joint operating agreement. The projected timeline is subject to accomplishing baseline data collection goals as outlined in Section III B (2), and may be amended to reflect weeks which do not meet data collection goals. A projected timeline is outlined below:

Target Pre-Intervention Timeline Baseline Roll-out		Valid Time Periods	Target Post-Intervention Telemedicine	Timeline
1. Maniilaq	1/26/98	12 wks.	5/4/98 – 6/30/99	56 wks.
2. YKHC	1/29/98	20 wks..	7/6/98 – 6/30/99	48 wks.
3. BBAHC	2/2/98	28 wks.	8/24/98 - 6/30/99	40 wks.
4. NSHC	2/5/98	36 wks.	10/9/98 – 6/30/99	32 wks.

As described in section III, B (2) a "valid time period" consists of 30 matched data sets involving a telemedicine consult among patient, primary provider and consulting physician.

Telemedicine Partnership
Section II

A. The University of Alaska Anchorage and the Alaska Native Health Board Agree:

1. To develop a scientifically viable research system that will evaluate the impacts of telemedicine on professional isolation, the cost of rural health care and gauge the participants' satisfaction with telemedicine technology.

2. To develop and make available to project participants a useful telemedicine and telehealth informatics system.

3. To research, develop and test store-and-forward telemedicine systems for installation at participating sites in rural Alaska, including hardware and software telemedicine solutions.

4. To develop comprehensive telemedicine procedures and protocols for the clinical applications being evaluated.

5. To develop telemedicine training materials and systems for project participants.

6. To purchase telemedicine equipment and software for project participants.

7. To deliver and install project equipment and software at participating sites.

8. To train participating health care professionals.

9. To support telemedicine systems over the life of the project through a comprehensive technical support plan, including a toll free support number.

10. To help project partners collect telemedicine evaluation data.

11. To analyze telemedicine evaluation data.

12. To share results with project partners.

B. Maniilaq Association Agrees:

1. To create a functioning telemedicine team within Maniilaq and establish a team leader or point person for the ATTP.

2. To engage sufficient health care professionals to participate in the ATTP study to ensure effective and continued flow of project data.

3. To identify two people who will be Maniilaq's telemedicine "superusers", who will facilitate training, installation and support for ATTP telemedicine systems.

4. To cooperate on the development and implementation of ATTP telemedicine training systems and events, including scheduling adequate time for the training of the identified superusers and participating Maniilaq staff as outlined in Appendix A.

5. To provide primary technical support for installed telemedicine equipment and software as outlined in Appendix C.

6. To implement a system for telemedicine training for all new employees who will be targeted for participation in the ATTP project.

7. To provide assistance in developing ATTP telemedicine procedures and protocols.

Evaluation
Section III

A. The University of Alaska Anchorage and the Alaska Native Health Board Agree:

1. To provide all evaluation forms and materials in a timely manner to the participating health organizations.

2. To strictly maintain patient and participant confidentiality throughout the course of the study.

3. To develop additional post-intervention survey forms in conjunction with participating health organizations. These forms will be consistent with pre-intervention survey forms and will be developed using a participatory model involving Maniilaq personnel.

B. Maniilaq Association Agrees:

1. To collect an informed consent form from each patient who participates in the telemedicine project or who receives care using the project's telemedicine equipment, and mail those forms to UAA in a timely manner.

2. To fill-out and collect "satisfaction" survey data at participating sites from all participating patients and health professionals during a pre-intervention baseline phase, for all presenting ear problems including radio medical traffic consultations or specialist referrals, field visits and follow-ups with the requirement of collecting matched three-party data sets from at least 30 referral events per week. The operative principle is 30 complete data sets per week. Each matched three-party set constitutes one of 30 complete data sets. Because of the nature of this study, each region is responsible for a minimum of 12 weeks and a maximum of 36 weeks of 30 complete data sets.

After the intervention of telemedicine, Maniilaq agrees to collect satisfaction survey data from all presenting ear problems that require radio medical traffic, specialist referrals or in which telemedicine equipment is used through the end of the project.

3. To provide general patient health record data during the course of the project, including but not limited to location, date of event, health record #, diagnosis and antibiotic use. Any additional data requests will be negotiated using the same collaborative process that has been used to develop other project evaluation materials.

4. To provide available budget information regarding travel and telecommunications for purposes of cost and benefit analysis to UAA for 1996 and over the course of the ATTP research project. Maniilaq agrees to set up tracking procedures for patient travel during the evaluation project period, if not already in place.

5. To provide employment information for the following Maniilaq job categories: doctors, nurses, physician assistants and CHA/P's (at participating clinics). This requested information will include but not be limited to start date, end date, job category and location, for the past 10 years (or up to 50 in each category) prior to the intervention of telemedicine equipment, and all personnel records for the above job categories after the intervention of telemedicine through the end of the project. Any additional data requests will be negotiated using the same collaborative process that has been used to develop other project evaluation materials.

Equipment and Software
Section IV

1. Project participants recognize that all project equipment and software is owned by the National Library of Medicine for the life of the project. All project equipment will have either a University of Alaska bar code decal or decal containing the wording "Property belongs to the University of Alaska." All project equipment will also have a tag stating "Property of U.S. Government."

2. The project equipment and software may be removed if UAA or ANHB deems that project data collection goals are not being met.

3. Maniilaq agrees to insure all project components, including computer workstations, medical imaging hardware and computer peripherals against unwarranted damage, breakage or theft for the life of the project.

4. Maniilaq and participating staff agree not to add any additional hardware or to load any additional software on NLM telemedicine computer workstations until the completion of the ATTP project, except with the express permission of UAA and ANHB.

5. It is the intent of UAA to leave all telemedicine equipment with the project partners at the end of the ATTP project.

Publication and Publicity
Section V

UAA shall review and approve any publication and publicity relating to the work of this project prior to release. Maniilaq Association shall acknowledge the support of the National Institutes of Health and the National Library of Medicine whenever publicizing the work under this contract in any media by including the following acknowledgement: "This project has been funded in whole or in part with Federal funds from the National Library of Medicine under Contract #N01-LM-6-3540."

Maniilaq Association shall review any publication relating to the project that contains Maniilaq data prior to release.

Copyright
Section VI

The University of Alaska Anchorage will maintain ownership of any intellectual property developed by or resulting from the Alaska Telemedicine Testbed Project. Confidentiality of research is subject to Alaska Statute 14.40.453.

Approvals
Section VII

UNIVERSITY OF ALASKA ANCHORAGE ASSOCIATION

Frederick W. Pearce, Ph.D.
Signature

Principal Investigator, NLM
Name/Title

1-28-98
Date

MANIILAQ ASSOCIATION

Dennis J. Siepelman
Signature

Dennis J. Siepelman, President/CEO
Name/Title

01/20/98
Date

ALASKA NATIVE HEALTH BOARD

Signature

PAUL SHERRY, DEPUTY DIRECTOR
Name/Title

1/28/98
Date

Approvals
Section VII

UNIVERSITY OF ALASKA ANCHORAGE ASSOCIATION

Frederick W. Peare, Ph.D.
Signature

Principal Investigator, NLM
Name/Title

1-28-98
Date

MANIILAQ ASSOCIATION

Dennis J. Siepelman
Signature

Dennis J. Siepelman, Pres./CEO
Name/Title

01/20/98
Date

ALASKA NATIVE HEALTH BOARD

Paul Sitterly
Signature

Paul Sitterly, Deputy Director
Name/Title

1/28/98
Date

National Library of Medicine
Alaska Telemedicine Testbed Project
Contract #N01-LM-6-3540

Joint Operating Agreement

University of Alaska, Anchorage
Alaska Native Health Board
Yukon Kuskokwim Health Corporation

Background

The National Library of Medicine has awarded the Applied Sciences Laboratory of the University of Alaska Anchorage (UAA) a contract to evaluate the effect of narrow bandwidth telemedicine and telehealth applications and technologies on the delivery of health care to rural Alaska. Specifically, the Alaska Telemedicine Testbed Project (ATTP) will study the impacts that the introduction of telemedicine technology will have on 1) the satisfaction of patients and health care providers with telemedicine technology; 2) the "professional isolation" of some rural health care professionals, and 3) the cost and benefit of using telemedicine to deliver health care to rural Alaska. The ATTP partners believe that the success of this project will help participating rural partners develop a business plan for the further implementation of cost efficient and clinically effective telemedicine and telehealth applications.

The University of Alaska Anchorage has contracted with the Alaska Native Health Board to 1) participate in the design and implementation of store and forward telemedicine systems and 2) liaison with participating rural health care organizations in the collection of project data. Through a state-wide selection process in March, 1997, Yukon Kuskokwim Health Corporation has been chosen as a partner in the Alaska Telemedicine Testbed Project. The Yukon Kuskowkim Regional Hospital and the health clinics in Chevak, Hooper Bay, Marshall, St. Mary's and Kotlik have been chosen as the participating facilities. The staff at these facilities will be the research adjuncts for the ATTP, and will participate in the collection of project data.

Project partners UAA and ANHB have selected ear infection and ear disease as the primary clinical application for the ATTP evaluation study. The project is funded through September 30, 1999. UAA will publish the results of this evaluation at the end of project in hopes of advancing knowledge in the emerging discipline of telemedicine and telehealth. The results of data collected from this project can be used by YKHC to chart a technology future for rural medicine in Alaska.

The following joint operating agreement language outlines the responsibilities of each partner in carrying this telemedicine research project forward.

Period of Agreement
Section I

Subject to approval by the National Library of Medicine, this agreement shall commence upon signing and shall terminate on June 30, 1999. The parties upon mutual consent may extend or amend this joint operating agreement. The projected timeline is subject to accomplishing baseline data collection goals as outlined in Section III B (2), and may be amended to reflect weeks which do not meet data collection goals. A projected timeline is outlined below:

Target Pre-Intervention Timeline Baseline Roll-out		Valid Time Periods	Target Post-Intervention Telemedicine	Timeline
1. Maniilaq	1/26/98	12 wks.	5/4/98 – 6/30/99	56 wks.
2. YKHC	1/29/98	20 wks..	7/6/98 – 6/30/99	48 wks.
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4. NSHC	2/5/98	36 wks.	10/9/98 – 6/30/99	32 wks.

As described in section III, B (2) a "valid time period" consists of 30 matched data sets involving a telemedicine consult among patient, primary provider and consulting physician.

Telemedicine Partnership
Section II

A. The University of Alaska Anchorage and the Alaska Native Health Board Agree:

1. To develop a scientifically viable research system that will evaluate the impacts of telemedicine on professional isolation, the cost of rural health care and gauge the participants' satisfaction with telemedicine technology.

2. To develop and make available to project participants a useful telemedicine and telehealth informatics system.

3. To research, develop and test store-and-forward telemedicine systems for installation at participating sites in rural Alaska, including hardware and software telemedicine solutions.

4. To develop comprehensive telemedicine procedures and protocols for the clinical applications being evaluated.

5. To develop telemedicine training materials and systems for project participants.

6. To purchase telemedicine equipment and software for project participants.

7. To deliver and install project equipment and software at participating sites.

8. To train participating health care professionals.

9. To support telemedicine systems over the life of the project through a comprehensive technical support plan, including a toll free support number.

10. To help project partners collect telemedicine evaluation data.

11. To analyze telemedicine evaluation data.

12. To share results with project partners.

B. Yukon Kuskokwim Health Corporation Agrees:

1. To create a functioning telemedicine team within YKHC and establish a team leader or point person for the ATTP.

2. To engage sufficient health care professionals to participate in the ATTP study to ensure effective and continued flow of project data.

3. To identify two people who will be YKHC's telemedicine "superusers", who will facilitate training, installation and support for ATTP telemedicine systems.

4. To cooperate on the development and implementation of ATTP telemedicine training systems and events, including scheduling adequate time for the training of the identified superusers and participating YKHC staff as outlined in Appendix A.

5. To provide primary technical support for installed telemedicine equipment and software as outlined in Appendix C.

6. To implement a system for telemedicine training for all new employees who will be targeted for participation in the ATTP project.

7. To provide assistance in developing ATTP telemedicine procedures and protocols.

Evaluation
Section III

A. The University of Alaska Anchorage and the Alaska Native Health Board Agree:

1. To provide all evaluation forms and materials in a timely manner to the participating health organizations.

2. To strictly maintain patient and participant confidentiality throughout the course of the study.

3. To develop additional post-intervention survey forms in conjunction with participating health organizations. These forms will be consistent with pre-intervention survey forms and will be developed using a participatory model involving YKHC personnel.

B. Yukon Kuskokwim Health Corporation Agrees:

1. To collect an informed consent form from each patient who participates in the telemedicine project or who receives care using the project's telemedicine equipment, and mail those forms to UAA in a timely manner.

2. To fill-out and collect "satisfaction" survey data at participating sites from all participating patients and health professionals during a pre-intervention baseline phase, for all presenting ear problems including radio medical traffic consultations or specialist referrals, field visits and follow-ups with the requirement of collecting matched three-party data sets from at least 30 referral events per week. The operative principle is 30 complete data sets per week. Each matched three-party set constitutes one of 30 complete data sets. Because of the nature of this study, each region is responsible for a minimum of 12 weeks and a maximum of 36 weeks of 30 complete data sets.

After the intervention of telemedicine, YKHC agrees to collect satisfaction survey data from all presenting ear problems that require radio medical traffic, specialist referrals or in which telemedicine equipment is used until the end of the project.

3. To provide general patient health record data during the course of the project, including but not limited to location, date of event, health record #, diagnosis and antibiotic use. Any additional data requests will be negotiated with YKHC in the same collaborative manner as has been used to develop other project evaluation materials.

4. To provide available budget information regarding travel and telecommunications for purposes of cost and benefit analysis to UAA for 1996 and over the course of the ATTP research project. YKHC agrees to set up tracking procedures for patient travel during the evaluation project period, if not already in place.

5. To provide employment information for the following YKHC job categories: doctors, nurses, physician assistants and CHA/P's (at participating clinics). This requested information will include but not be limited to start date, end date, job category and location, for the past 10 years (or up to 50 in each category) prior to the intervention of telemedicine equipment, and all personnel records for the above job categories after the intervention of telemedicine. Any additional data requests will be negotiated with YKHC in the same collaborative manner as has been used to develop other project evaluation materials.

Equipment and Software
Section IV

1. Project participants recognize that all project equipment and software is owned by the National Library of Medicine for the life of the project. All project equipment will have either a University of Alaska bar code decal or decal containing the wording "Property belongs to the University of Alaska." All project equipment will also have a tag stating "Property of U.S. Government."

2. The project equipment and software may be removed if UAA or ANHB deems that project data collection goals are not being met.

3. YKHC agrees to insure all project component, including computer workstations, medical imaging hardware and computer peripherals against unwarranted damage, breakage or theft for life of project.

4. YKHC and participating staff agree not to add any additional hardware or to load any additional software on NLM telemedicine computer workstations until the completion of the ATTP project, except with the express permission of UAA and ANHB.

5. It is the intent of UAA to leave all telemedicine equipment with the project partners at the end of the ATTP project.

Publication and Publicity
Section V

UAA shall review and approve any publication and publicity relating to the work of this project prior to release. YKHC shall acknowledge the support of the National Institutes of Health and the National Library of Medicine whenever publicizing the work under this contract in any media by including the following acknowledgement: "This project has been funded in whole or in part with Federal funds from the National Library of Medicine under Contract #N01-LM-6-3540."

YKHC shall review ny publication relating to the project that contains BBAHC data prior to release.

Copyright
Section VI

The University of Alaska Anchorage will maintain ownership of any intellectual property developed by or resulting from the Alaska Telemedicine Testbed Project. Confidentiality of research is subject to Alaska Statute 14.40.453.

Approvals
Section VII

UNIVERSITY OF ALASKA ANCHORAGE

Frederick W Peone, Ph.D.
Signature

Principal Investigator, NLM
Name/Title

1-28-98
Date

YUKON KUSKOKWIM HEALTH CORPORATION

Signature

CEO, Gene PeHola
Name/Title

1/19/98
Date

ALASKA NATIVE HEALTH BOARD

Signature

PAUL SHERRY, ACTING DIRECTOR
Name/Title

1/27/98
Date

Approvals
Section VII

UNIVERSITY OF ALASKA ANCHORAGE

Frederick W Perry, PhD.
Signature

Principal Investigator, NLM
Name/Title

1-28-98
Date

YUKON KUSKOKWIM HEALTH CORPORATION

Signature

Gene Peltola, CEO
Name/Title

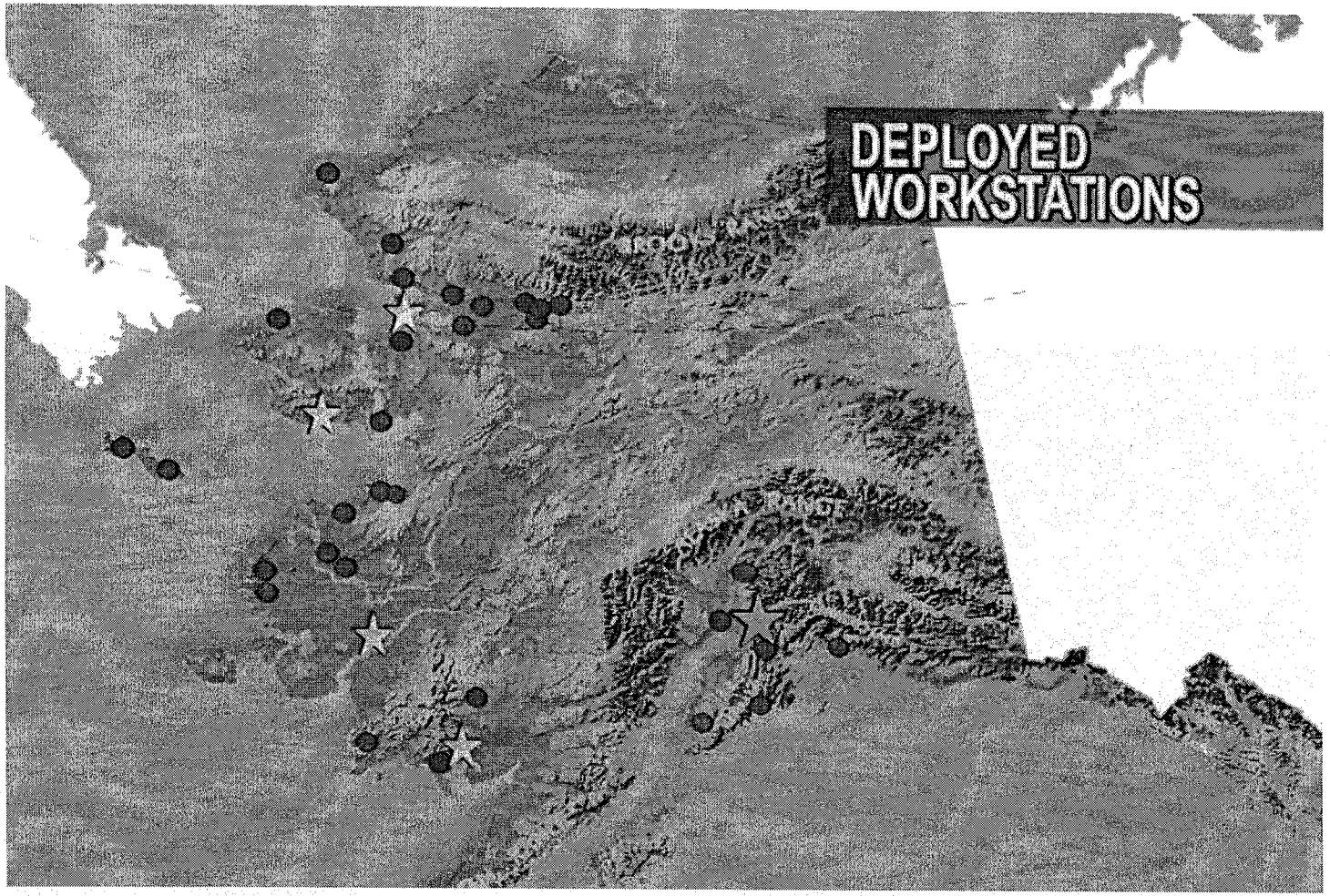
1/19/98
Date

ALASKA NATIVE HEALTH BOARD

Signature

PAUL SHERRY, DEPUTY DIRECTOR
Name/Title

1-27-98
Date



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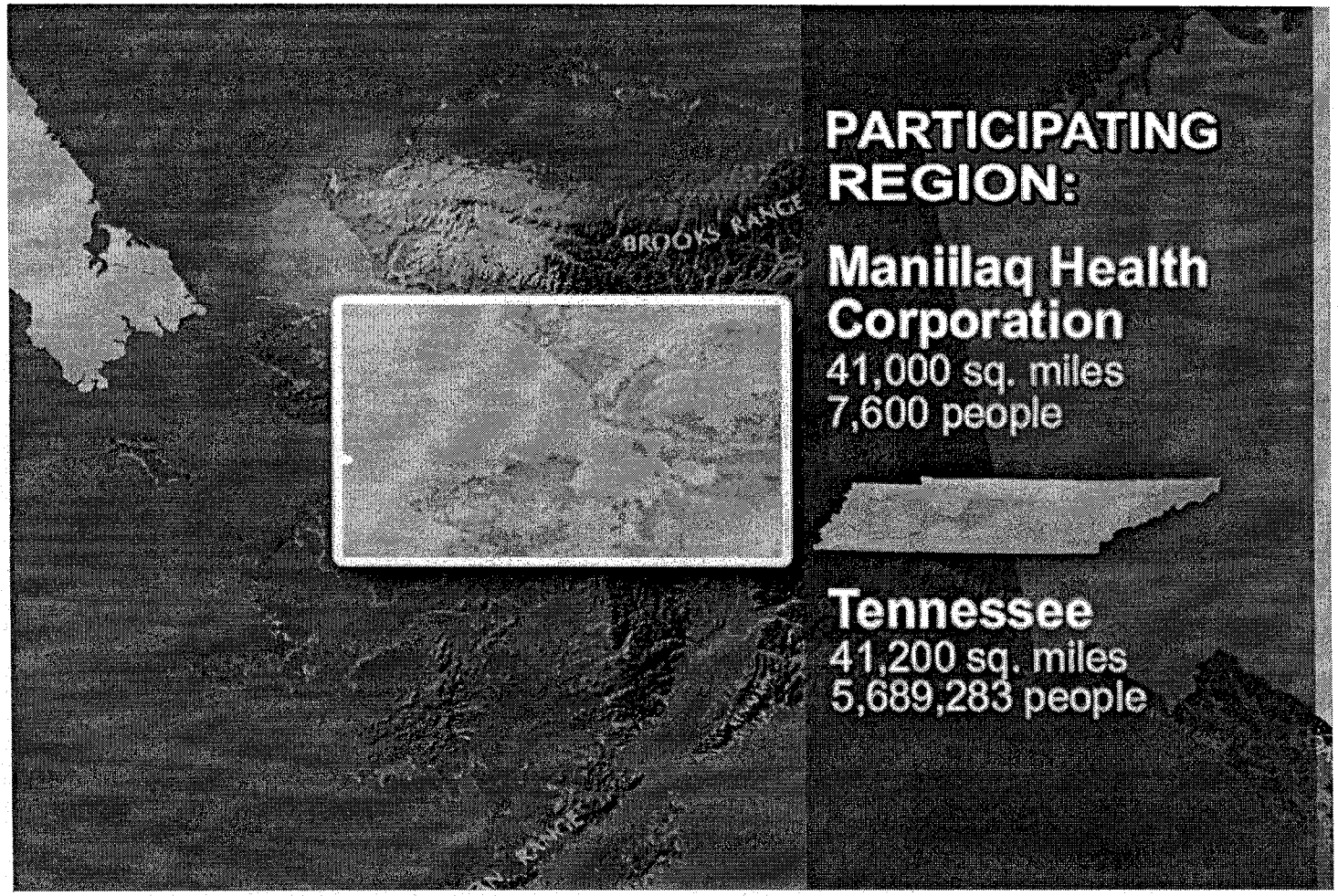
BROOKS RANGE
PARTICIPATING REGION:
Manilaq Health Corporation
41,000 sq. miles
7,600 people
Tennessee
41,200 sq. miles
5,689,283 people

3.2

MANIILAQ
HEALTH
CORPORATION
Kotzebue
Ambler
Buckland
Deering
Kiana
Kivalina
Kobuk
Noatak
Noorvik
Selewik
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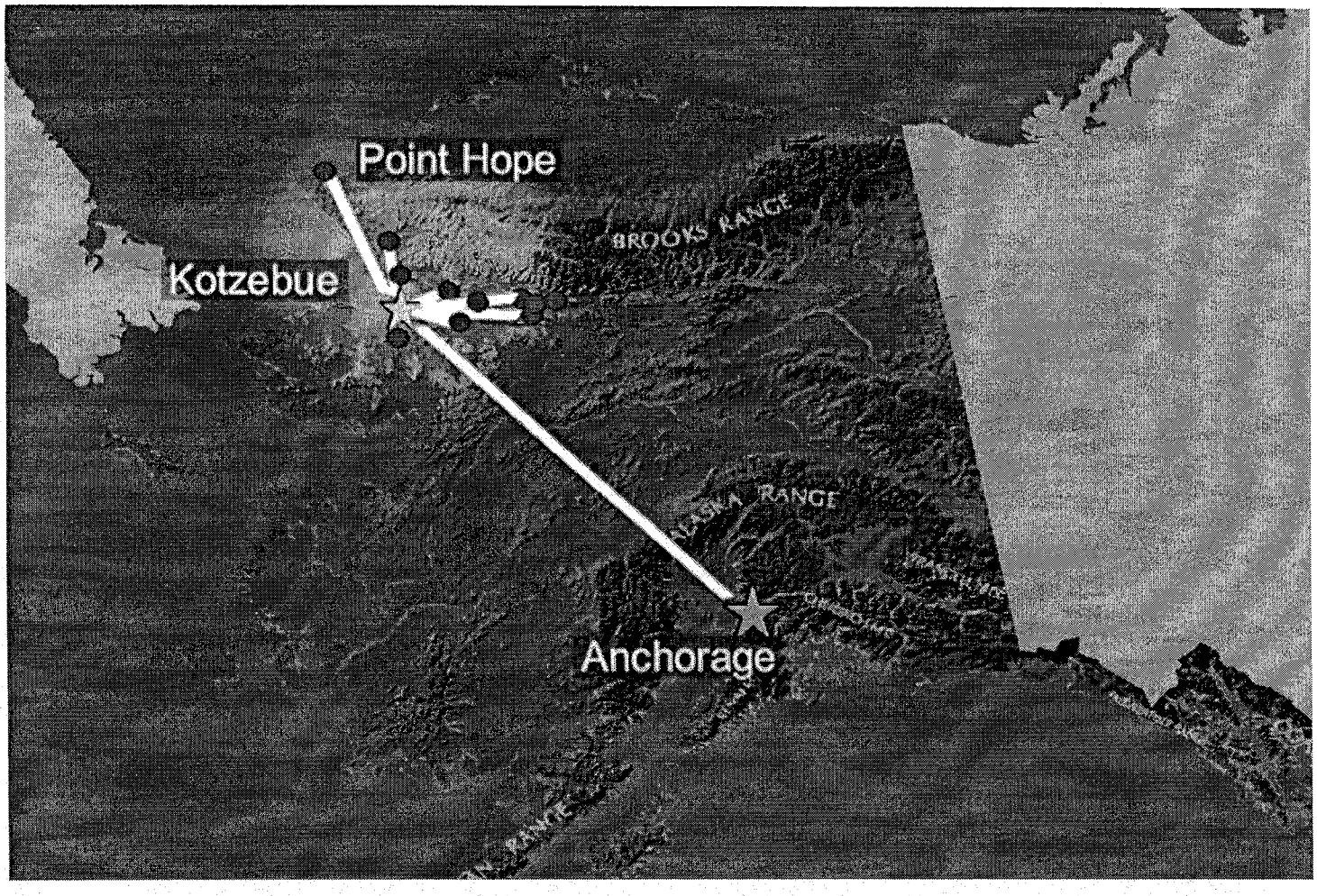
Point Hope*
BROOKS RANGE
ALASKA RA



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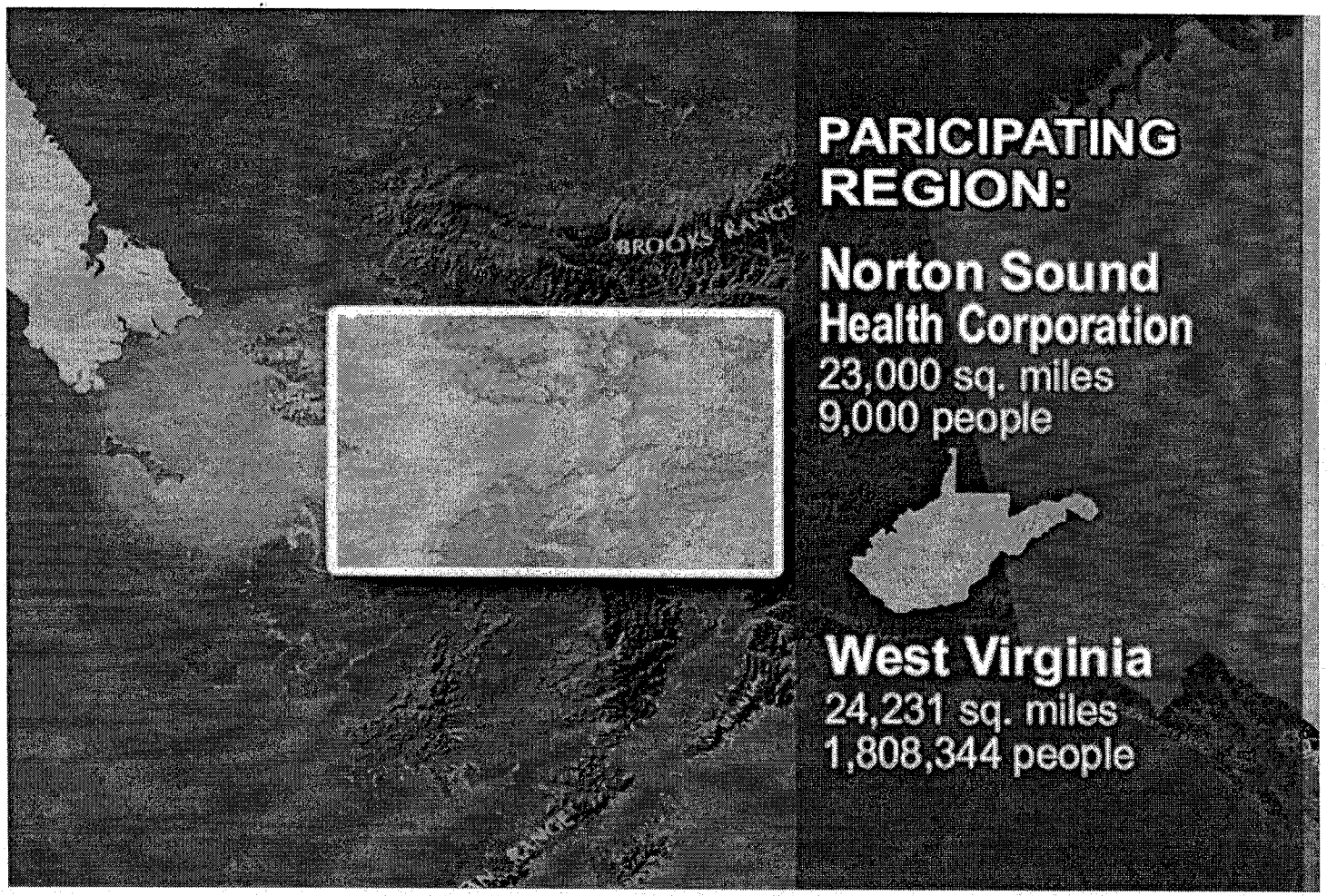
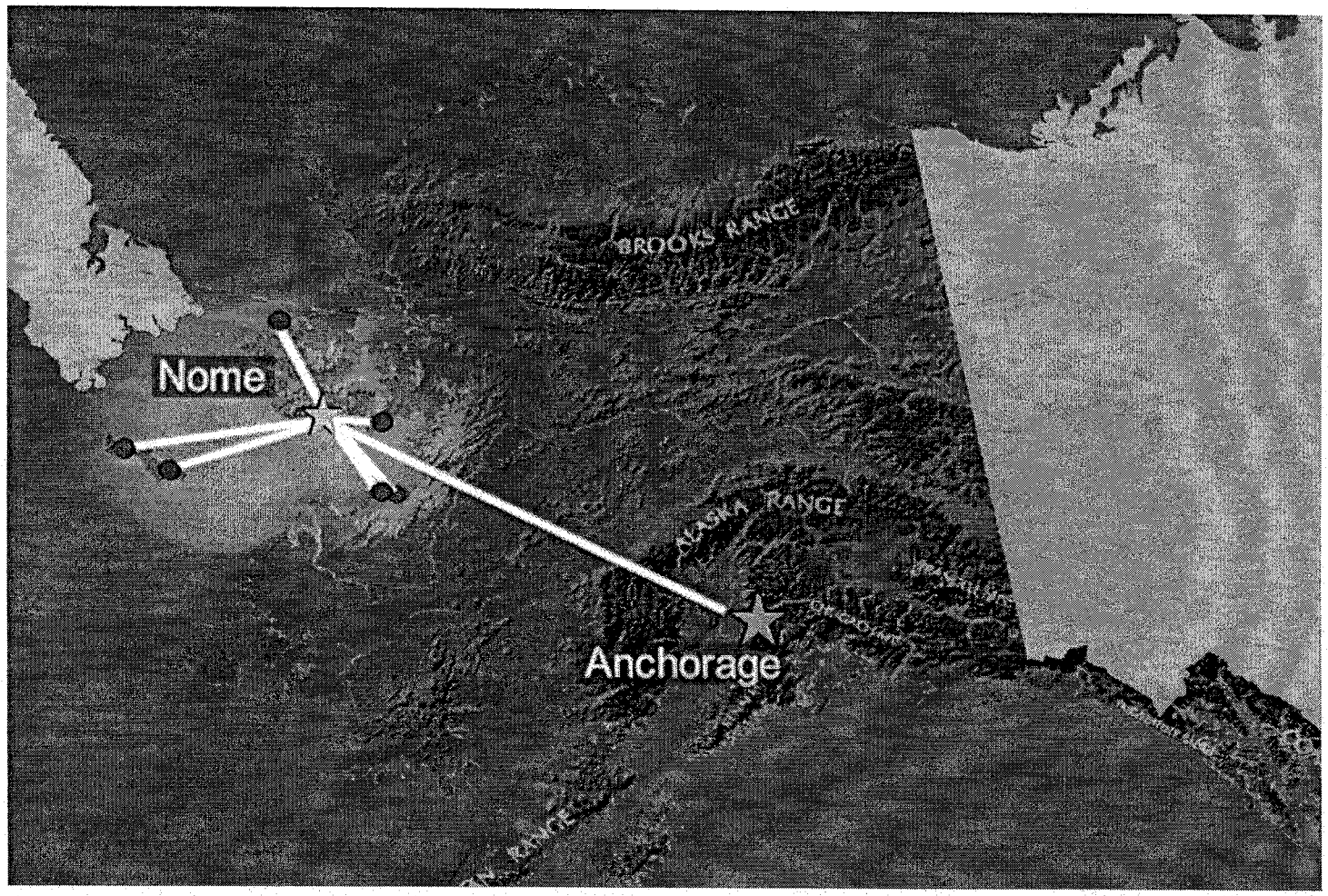
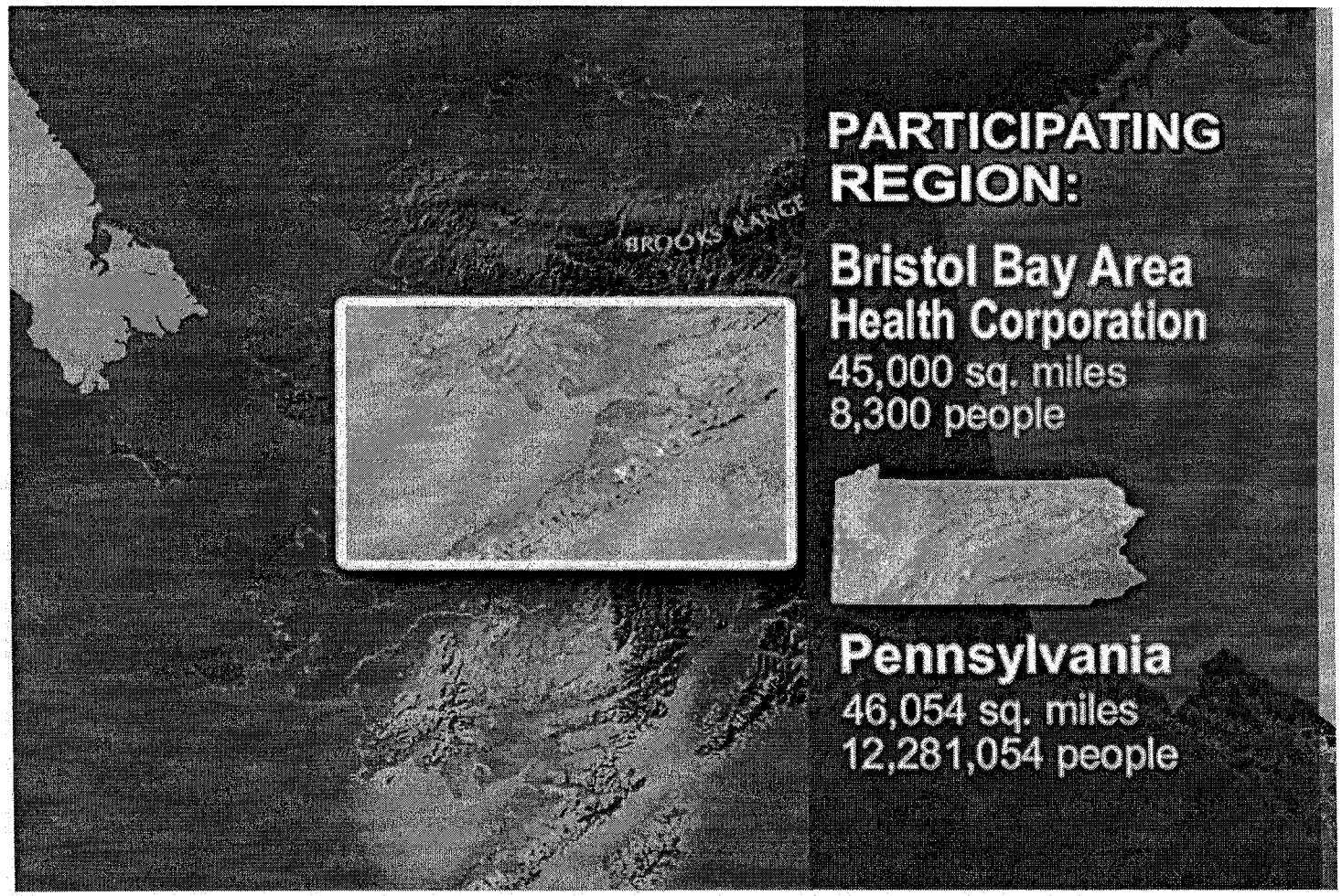

BROOKS RANGE
PARICIPATING REGION:
Norton Sound Health Corporation
23,000 sq. miles
9,000 people
West Virginia
24,231 sq. miles
1,808,344 people

BROOKS RANGE
ALASKA RA
NORTON
SOUND
HEALTH
CORPORATION
Nome
Elim
Gambell
Savoonga
Shishmaref
Stebbins
Saint Michael*

3.6

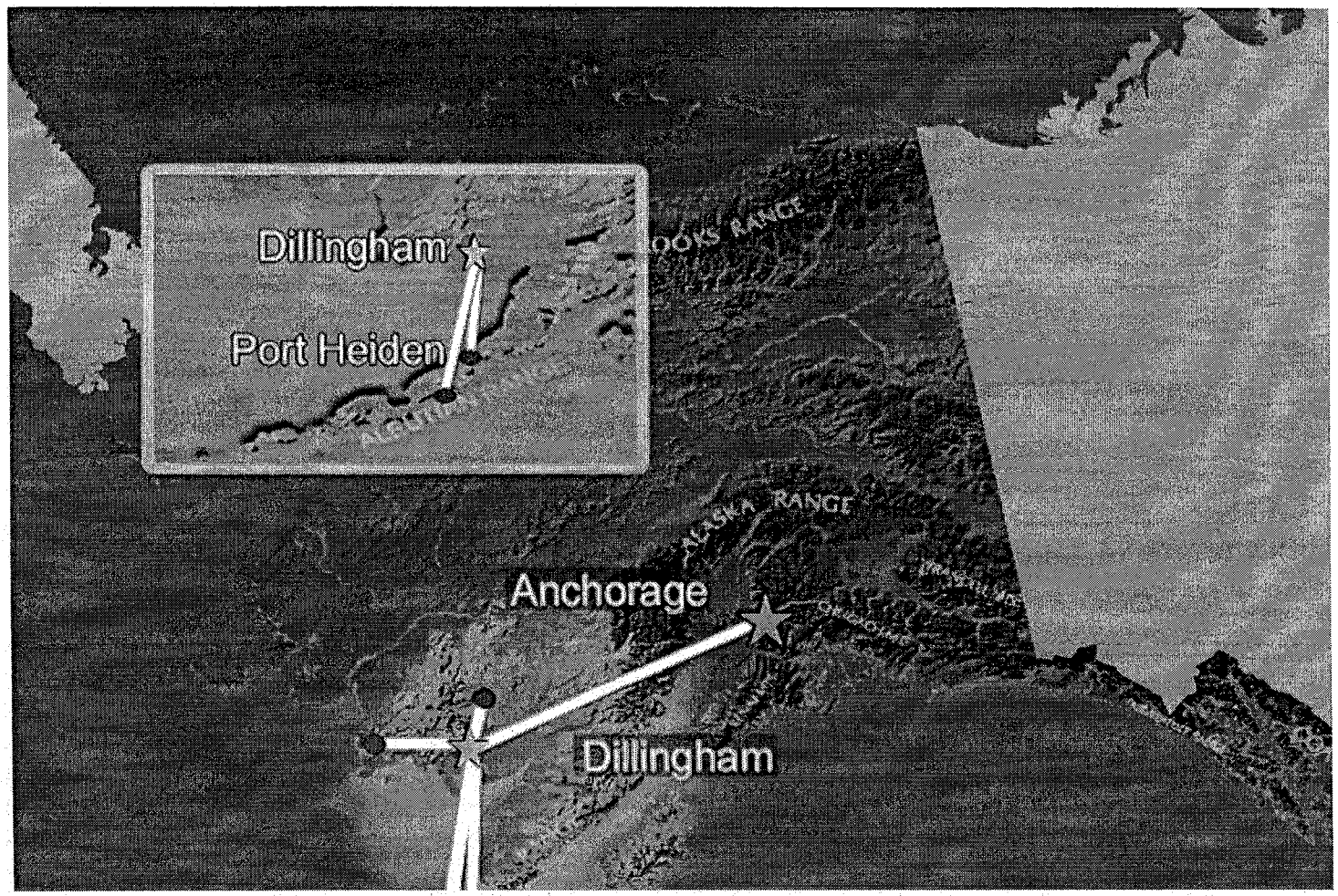


3.7


BROOKS RANGE
PARTICIPATING REGION:
Bristol Bay Area Health Corporation
45,000 sq. miles
8,300 people
Pennsylvania
46,054 sq. miles
12,281,054 people

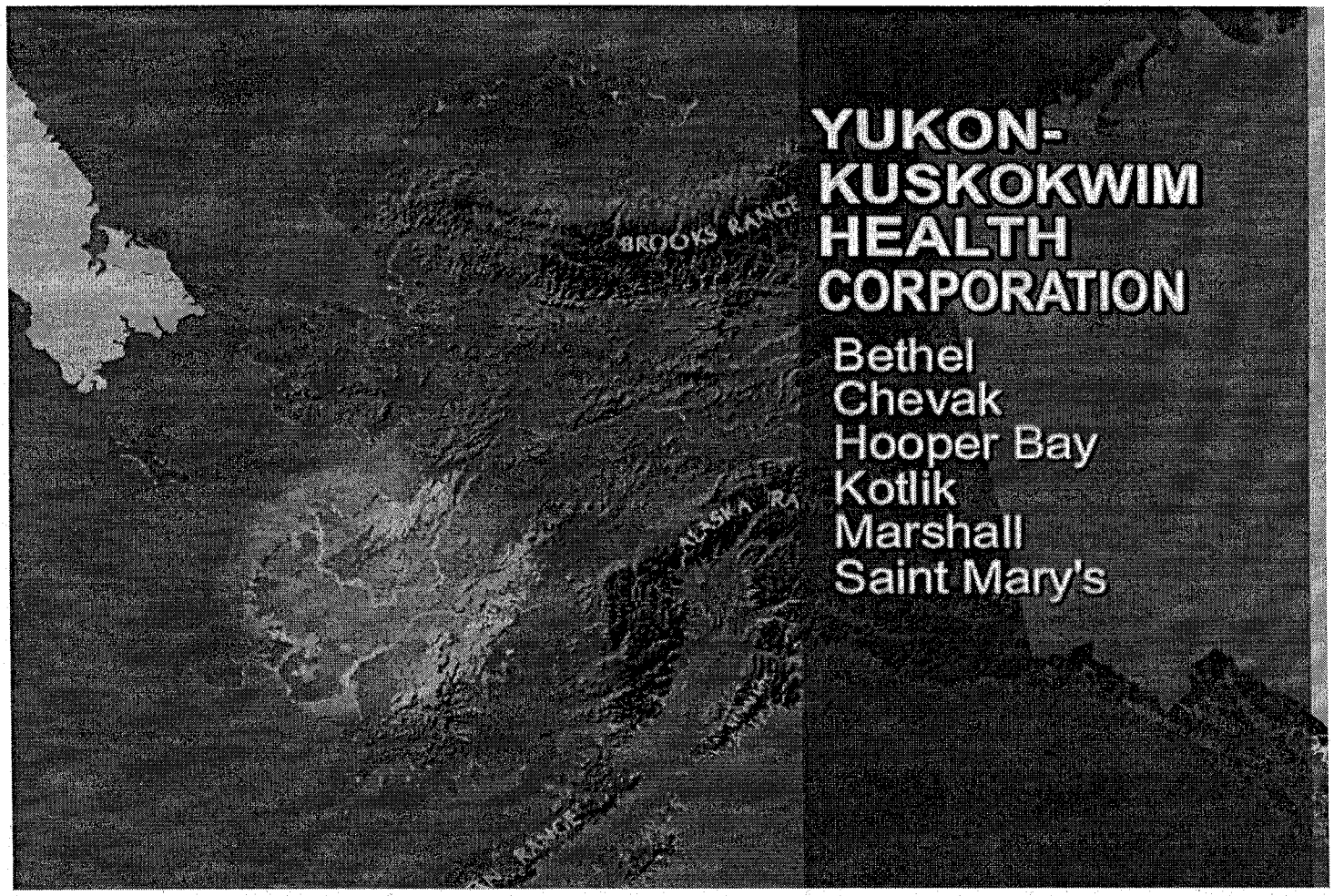
BROOKS RANGE
ALASKA RA
BRISTOL
BAY AREA
HEALTH
CORPORATION
Dillingham
Goodnews Bay
Koliganek
Manokotak
Perryville
Port Heiden

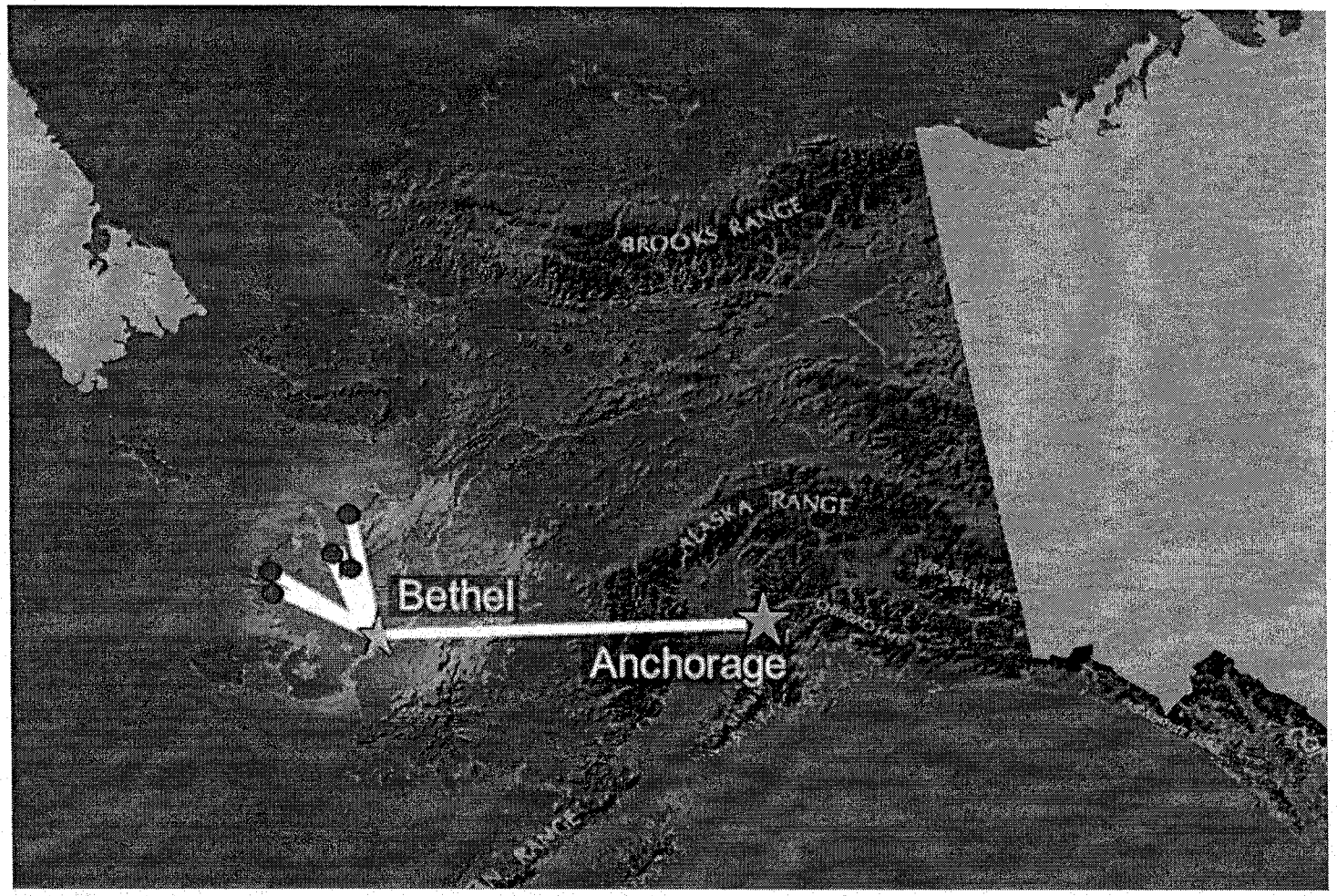
3.9


Dillingham
Port Heiden
ALASKA RANGE
Anchorage
Dillingham

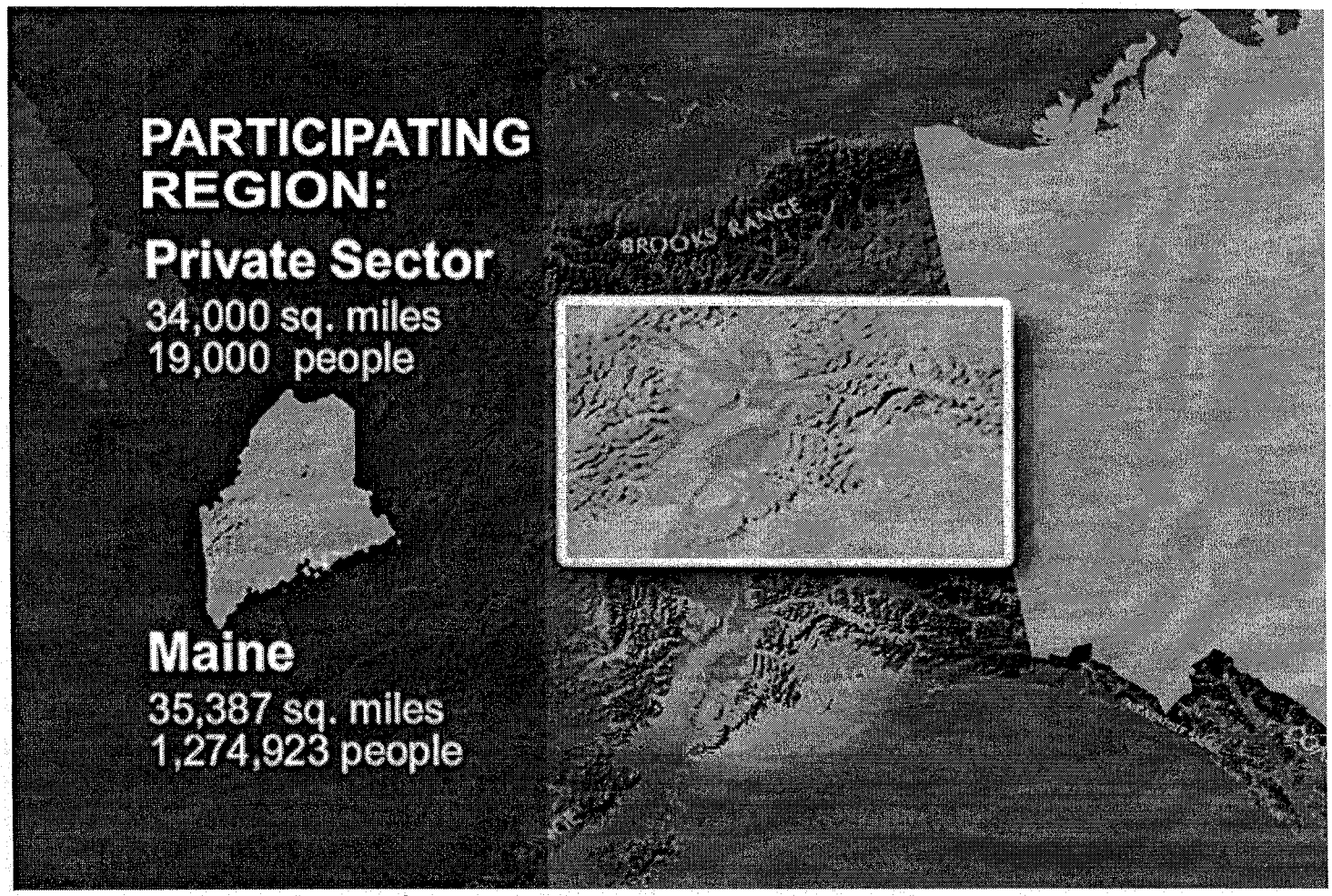
BROOKS RANGE
PARTICIPATING REGION:
Yukon-Kuskokwim Health Corporation
76,000 sq. miles
20,000 people
South Dakota
77,121 sq. miles
754,844 people

3.11

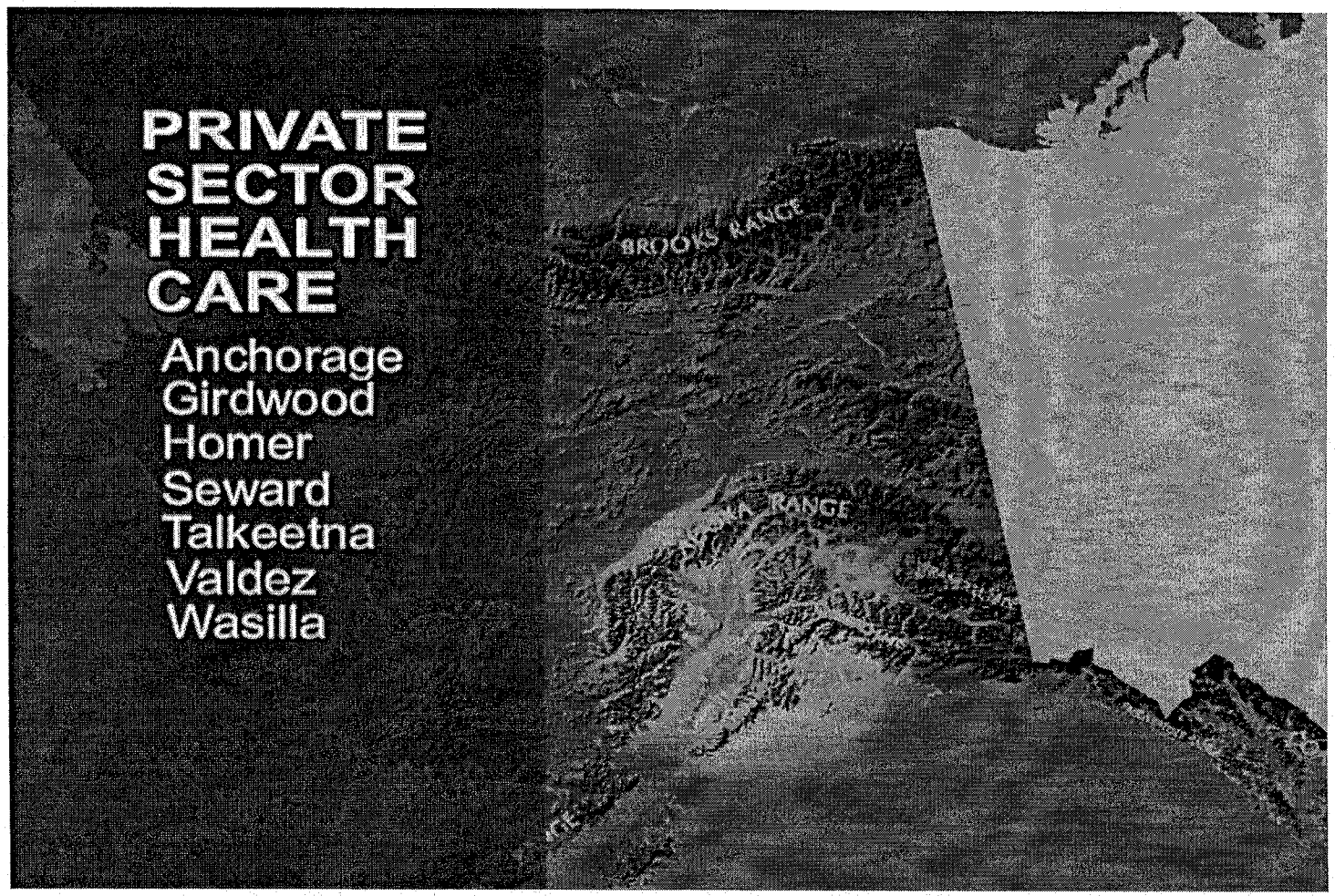

YUKON-
KUSKOKWIM
HEALTH
CORPORATION
Bethel
Chevak
Hooper Bay
Kotlik
Marshall
Saint Mary's
BROOKS RANGE



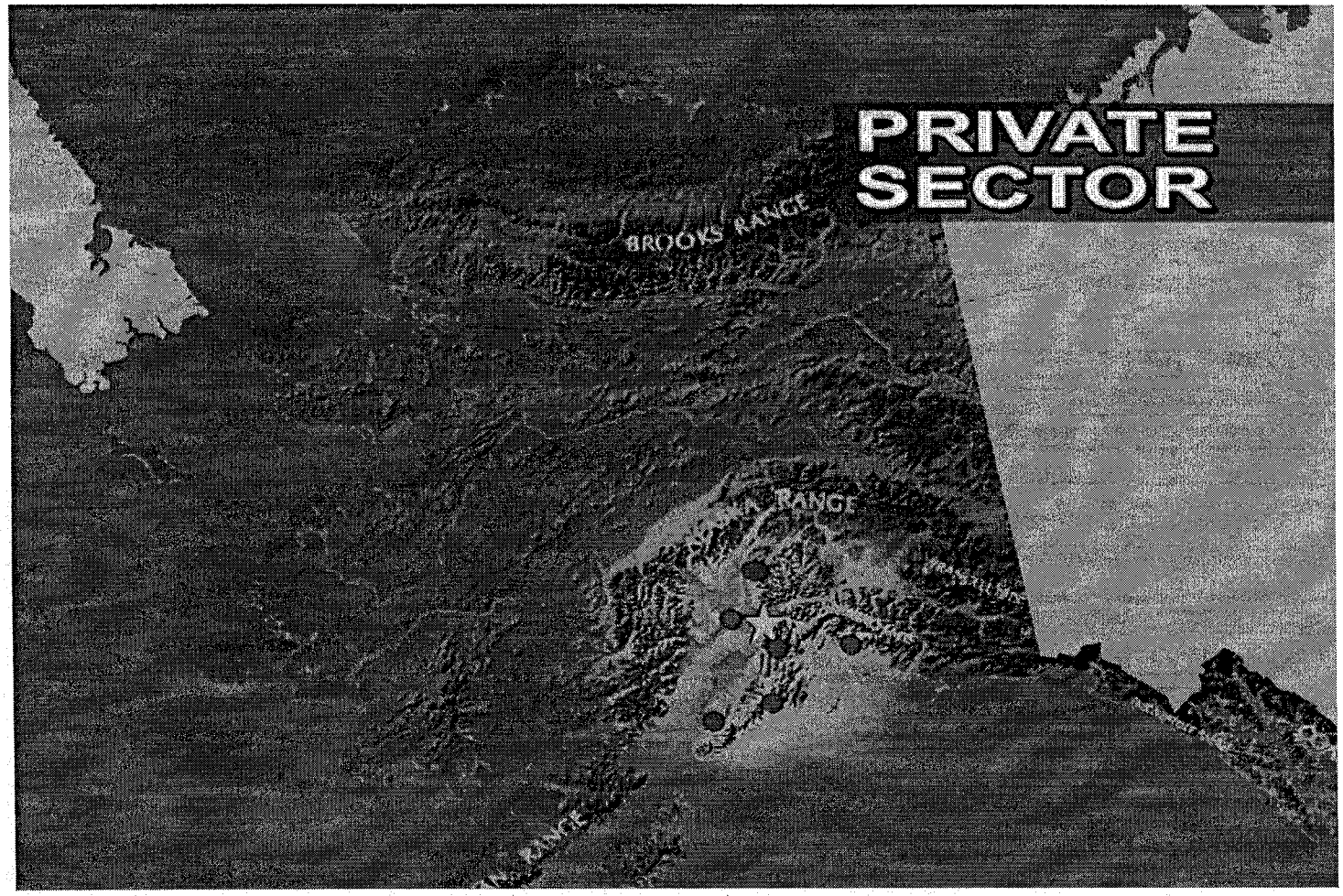
3.13


PARTICIPATING REGION:
Private Sector
34,000 sq. miles
19,000 people
Maine
35,387 sq. miles
1,274,923 people
BROOKS RANGE

3.14


PRIVATE
SECTOR
HEALTH
CARE
Anchorage
Girdwood
Homer
Seward
Talkeetna
Valdez
Wasilla
BROOKS RANGE

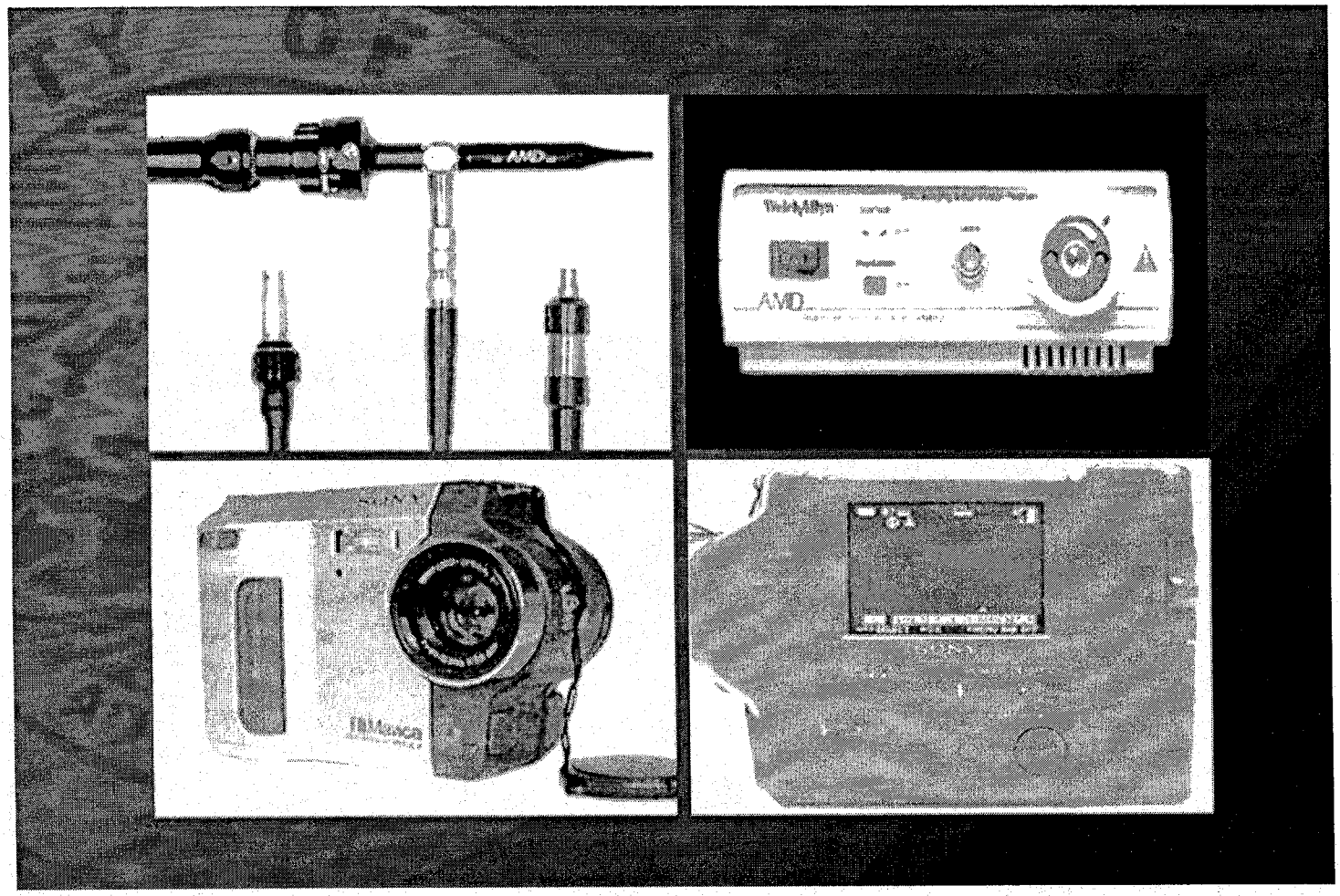
3.15



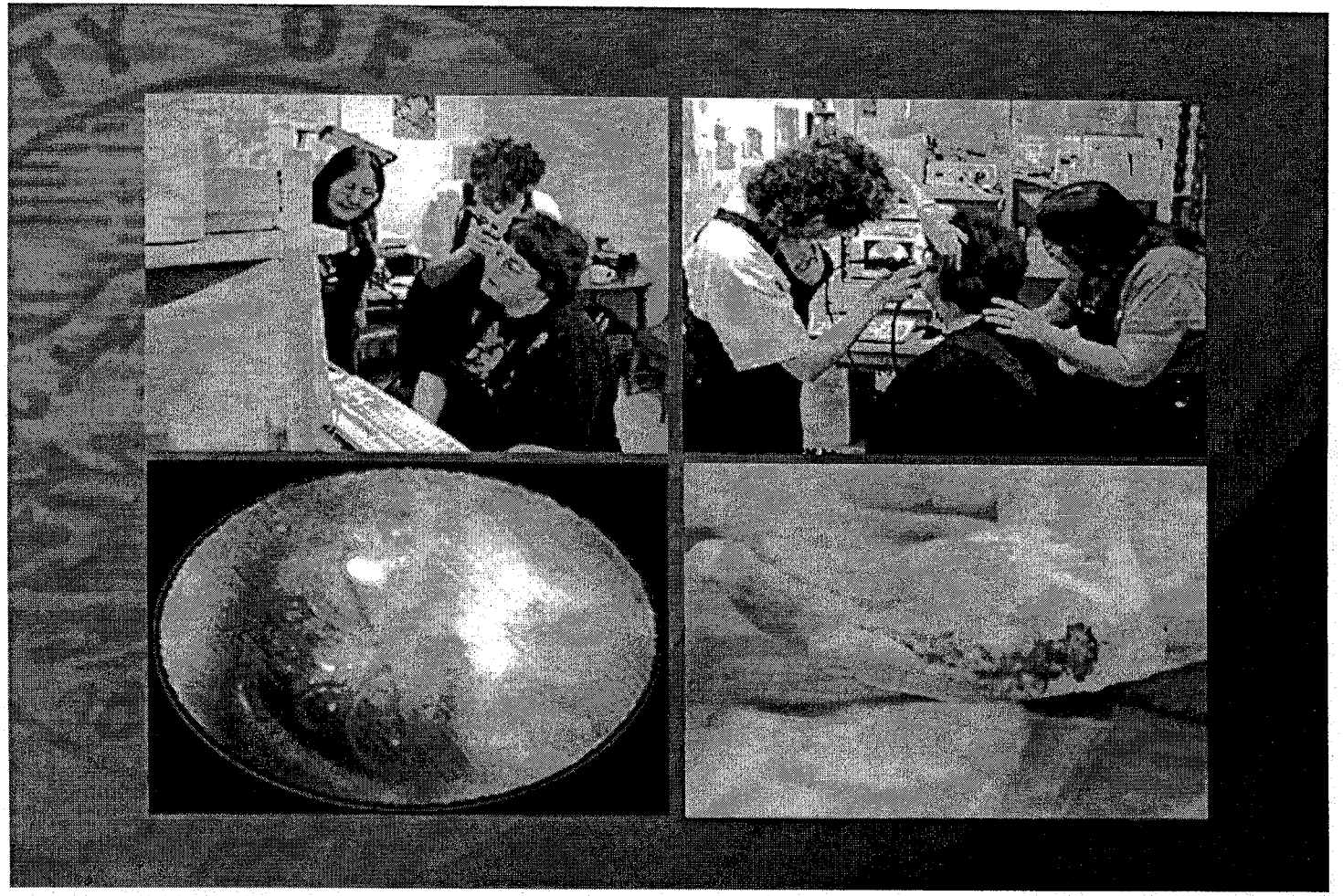
3.16

ATTP Telehealth Workstation

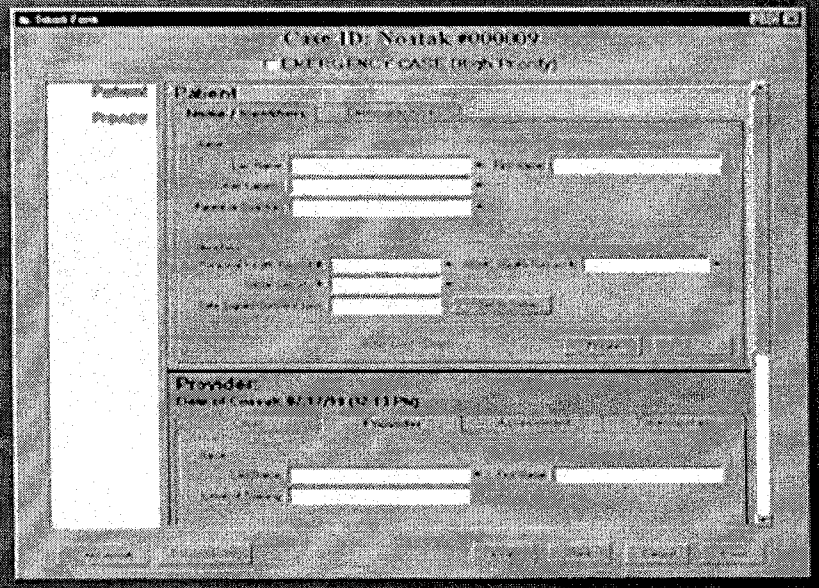
3,17



3.18



ATTP Clinical Software



3,20

Unique	Case ID	Case Number	Case Origin (Village)	Consult Level	Day of Week	Patient Age Category	Patient Age (Years)	# Images	Month	Otoscope Used
Latest 2	Ambler #000001	1	Ambler	2	Thursday	(c) 19 to 44	20.7	4	Mar-99	YES
Latest 2	Ambler #000007	7	Ambler	2	Thursday	(a) 0 to 4	1.6	14	Feb-99	YES
Latest 2	Ambler #000008	8	Ambler	2	Tuesday	(a) 0 to 4	0.6	1	Apr-99	YES
Latest 1	Ambler #000010	10	Ambler	1	Wednesday	(b) 5 to 18	6.8	4	Apr-99	YES
Latest 2	Ambler #000011	11	Ambler	2	Thursday	(d) 45 to 64	53.8	4	Feb-99	YES
Latest 2	Ambler #000015	15	Ambler	2	Friday	(b) 5 to 18	14.1	4	Feb-99	YES
Latest 2	Ambler #000016	16	Ambler	2	Monday	(c) 19 to 44	42.1	8	Feb-99	YES
Latest 1	Ambler #000018	18	Ambler	1	Wednesday	(a) 0 to 4	1.9	1	May-99	YES
Latest 2	Ambler #000019	19	Ambler	2	Thursday	(c) 19 to 44	39.0	3	Feb-99	NO
Latest 2	Ambler #000020	20	Ambler	2	Thursday	(b) 5 to 18	9.1	4	May-99	NO
Latest 1	Ambler #000021	21	Ambler	1	Friday	(b) 5 to 18	10.5	2	May-99	NO
Latest 1	Ambler #000022	22	Ambler	1	Monday	(d) 45 to 64	44.4	2	May-99	NO
Latest 1	Ambler #000023	23	Ambler	1	Monday	(c) 19 to 44	42.4	4	May-99	NO
Latest 1	Ambler #000024	24	Ambler	1	Friday	(b) 5 to 18	16.5	7	May-99	YES
Latest 1	Ambler #000025	25	Ambler	1	Monday	(b) 5 to 18	17.8	6	Jun-99	NO
Latest 1	Ambler #000026	26	Ambler	1	Tuesday	(d) 45 to 64	50.9	2	Jun-99	NO
Latest 1	Ambler #000027	27	Ambler	1	Wednesday	(d) 45 to 64	44.5	5	Jun-99	NO
Latest 2	Ambler #000028	28	Ambler	2	Wednesday	n/a	-1.0	2	Jun-99	NO
Latest 2	Ambler #000029	29	Ambler	2	Friday	(a) 0 to 4	4.0	4	Mar-99	YES
Latest 1	Ambler #000030	30	Ambler	1	Tuesday	(a) 0 to 4	1.5	6	Mar-99	YES
Latest 2	Ambler #000031	31	Ambler	2	Thursday	(c) 19 to 44	36.8	5	Jun-99	YES
Latest 1	Ambler #000032	32	Ambler	1	Thursday	(a) 0 to 4	3.1	6	Jun-99	YES
Latest 1	Ambler #000033	33	Ambler	1	Thursday	) 65 and olde	70.5	3	Jul-99	NO
Latest 2	Ambler #000034	34	Ambler	2	Friday	(c) 19 to 44	34.8	4	Jul-99	NO
Latest 1	Ambler #000036	36	Ambler	1	Tuesday	(c) 19 to 44	41.7	4	Jul-99	NO
Latest 2	Ambler #000037	37	Ambler	2	Tuesday	(b) 5 to 18	4.7	2	Jul-99	YES
Latest 1	Ambler #000038	38	Ambler	1	Wednesday	(c) 19 to 44	22.7	6	Jul-99	YES
Latest 1	Ambler #000039	39	Ambler	1	Monday	(c) 19 to 44	39.2	5	Jul-99	NO
Latest 1	Ambler #000040	40	Ambler	1	Tuesday	(a) 0 to 4	2.1	2	Jul-99	NO
Latest 1	Ambler #000041	41	Ambler	1	Tuesday	(c) 19 to 44	29.6	3	Jul-99	NO
Latest 1	Ambler #000042	42	Ambler	1	Monday	(a) 0 to 4	2.2	6	Aug-99	YES

Latest 1	Ambler #000043	43	Ambler	1	Wednesday	(b) 5 to 18	10.1	7	Sep-99	NO
Latest 2	Ambler #000044	44	Ambler	2	Thursday	(a) 0 to 4	2.2	7	Sep-99	YES
Latest 1	Ambler #000045	45	Ambler	1	Wednesday	(c) 19 to 44	21.2	3	Sep-99	YES
Latest 1	Ambler #000047	47	Ambler	1	Thursday	(b) 5 to 18	14.7	6	Sep-99	YES
Latest 1	Ambler #000048	48	Ambler	1	Monday	(a) 0 to 4	1.0	6	Sep-99	NO
Latest 1	Ambler #000049	49	Ambler	1	Monday	(b) 5 to 18	17.6	3	Sep-99	NO
Latest 1	Ambler #000050	50	Ambler	1	Friday	(b) 5 to 18	7.3	4	Sep-99	NO
Latest 1	Ambler #000051	51	Ambler	1	Monday	(d) 45 to 64	54.4	4	Sep-99	YES
Latest 1	Ambler #000052	52	Ambler	1	Monday	(c) 19 to 44	39.6	6	Sep-99	NO
Latest 1	Ambler #000053	53	Ambler	1	Thursday	(b) 5 to 18	16.2	3	Sep-99	NO
Latest 1	Ambler #000054	54	Ambler	1	Friday	(c) 19 to 44	39.6	5	Sep-99	NO
Latest 1	Ambler #000055	55	Ambler	1	Saturday	(c) 19 to 44	39.6	3	Sep-99	NO
Latest 1	Ambler #000056	56	Ambler	1	Tuesday	(a) 0 to 4	1.1	6	Oct-99	YES
Latest 1	Ambler #000057	57	Ambler	1	Tuesday	(b) 5 to 18	17.7	6	Oct-99	YES
Latest 1	Ambler #000058	58	Ambler	1	Friday	(c) 19 to 44	39.6	3	Oct-99	NO
Latest 1	Ambler #000059	59	Ambler	1	Friday	(c) 19 to 44	39.7	4	Oct-99	NO
Latest 1	Ambler #000060	60	Ambler	1	Wednesday	(b) 5 to 18	10.2	3	Oct-99	NO
Latest 1	Ambler #000061	61	Ambler	1	Thursday	(b) 5 to 18	10.2	3	Oct-99	NO
Latest 1	Ambler #000062	62	Ambler	1	Thursday	(b) 5 to 18	4.6	4	Oct-99	NO
Latest 1	Ambler #000063	63	Ambler	1	Thursday	(b) 5 to 18	4.1	3	Nov-99	NO
Latest 1	Ambler #000064	64	Ambler	1	Tuesday	) 65 and olde	79.8	3	Nov-99	NO
Latest 1	Ambler #000065	65	Ambler	1	Monday	(b) 5 to 18	17.8	3	Nov-99	NO
Latest 1	Ambler #000066	66	Ambler	1	Tuesday	(b) 5 to 18	17.8	4	Nov-99	NO
Latest 1	Ambler #000067	67	Ambler	1	Wednesday	(d) 45 to 64	63.4	7	Nov-99	NO
Latest 1	Ambler #000068	68	Ambler	1	Thursday	(b) 5 to 18	6.7	7	Nov-99	YES
Latest 1	Ambler #000069	69	Ambler	1	Thursday	(b) 5 to 18	8.6	2	Nov-99	NO
Latest 1	Ambler #000070	70	Ambler	1	Monday	(a) 0 to 4	1.2	4	Nov-99	NO
Latest 1	Ambler #000071	71	Ambler	1	Thursday	(c) 19 to 44	32.0	2	Dec-99	NO
Latest 1	Ambler #000072	72	Ambler	1	Thursday	(c) 19 to 44	25.6	3	Dec-99	NO
Latest 1	Ambler #000073	73	Ambler	1	Friday	(c) 19 to 44	39.8	4	Dec-99	NO
Latest 1	Ambler #000074	74	Ambler	1	Monday	(c) 19 to 44	42.0	1	Dec-99	NO
Latest 1	Ambler #000075	75	Ambler	1	Monday	(c) 19 to 44	42.0	4	Dec-99	NO
Latest 1	Ambler #000076	76	Ambler	1	Monday	(b) 5 to 18	14.0	3	Dec-99	YES
Latest 1	Ambler #000077	77	Ambler	1	Friday	(c) 19 to 44	34.5	1	Dec-99	NO
Latest 1	Ambler #000078	78	Ambler	1	Tuesday	(c) 19 to 44	34.0	3	Jan-00	YES

Latest 1	Ambler #000079	79	Ambler	1	Thursday	(b) 5 to 18	6.4	7	Jan-00	YES
Latest 1	Ambler #000080	80	Ambler	1	Friday	(b) 5 to 18	14.9	4	Jan-00	YES
Latest 1	Ambler #000081	81	Ambler	1	Friday	(c) 19 to 44	37.4	3	Jan-00	YES
Latest 1	Ambler #000082	82	Ambler	1	Monday	(c) 19 to 44	43.0	3	Jan-00	NO
Latest 1	Ambler #000084	84	Ambler	1	Monday	(b) 5 to 18	13.5	3	Jan-00	YES
Latest 1	Ambler #000085	85	Ambler	1	Friday	(b) 5 to 18	6.4	4	Feb-00	NO
Latest 1	Ambler #000086	86	Ambler	1	Friday	(c) 19 to 44	40.0	6	Feb-00	NO
Latest 1	Ambler #000087	87	Ambler	1	Monday	(c) 19 to 44	22.7	2	Feb-00	NO
Latest 1	Ambler #000088	88	Ambler	1	Tuesday	(d) 45 to 64	52.7	3	Feb-00	NO
Latest 1	Ambler #000089	89	Ambler	1	Wednesday	(c) 19 to 44	21.8	5	Mar-00	NO
Latest 1	Ambler #000090	90	Ambler	1	Thursday	(b) 5 to 18	4.3	5	Mar-00	NO
Latest 1	Ambler #000091	91	Ambler	1	Friday	(a) 0 to 4	0.7	4	Mar-00	NO
Latest 1	Ambler #000092	92	Ambler	1	Friday	(b) 5 to 18	14.4	3	Mar-00	NO
Latest 1	Ambler #000093	93	Ambler	1	Tuesday	) 65 and olde	95.3	4	Mar-00	NO
Latest 1	Ambler #000096	96	Ambler	1	Thursday	(c) 19 to 44	41.0	4	Mar-00	NO
Latest 1	Ambler #000097	97	Ambler	1	Tuesday	(c) 19 to 44	39.9	3	Apr-00	NO
Latest 1	Ambler #000098	98	Ambler	1	Wednesday	(d) 45 to 64	46.6	6	Apr-00	NO
Latest 1	Ambler #000100	100	Ambler	1	Tuesday	(d) 45 to 64	55.6	3	Apr-00	NO
Latest 1	Ambler #000101	101	Ambler	1	Monday	(d) 45 to 64	55.1	3	Apr-00	NO
Latest 1	Ambler #000103	103	Ambler	1	Thursday	(b) 5 to 18	15.7	7	Apr-00	YES
Latest 1	Ambler #000104	104	Ambler	1	Friday	(d) 45 to 64	48.7	3	Apr-00	NO
Latest 1	Ambler #000105	105	Ambler	1	Friday	(d) 45 to 64	48.7	1	Apr-00	NO
Latest 1	Ambler #000106	106	Ambler	1	Monday	(b) 5 to 18	9.0	3	Apr-00	NO
Latest 1	Ambler #000107	107	Ambler	1	Monday	(a) 0 to 4	3.3	1	Apr-00	NO
Latest 1	Ambler #000108	108	Ambler	1	Monday	(a) 0 to 4	1.4	3	Apr-00	YES
Latest 1	Ambler #000109	109	Ambler	1	Tuesday	(d) 45 to 64	48.7	3	Apr-00	NO
Latest 1	Ambler #000110	110	Ambler	1	Tuesday	(a) 0 to 4	3.3	3	Apr-00	NO
Latest 1	Ambler #000111	111	Ambler	1	Friday	(b) 5 to 18	8.1	2	May-00	NO
Latest 1	Ambler #000112	112	Ambler	1	Monday	) 65 and olde	75.6	1	May-00	NO
Latest 1	Ambler #000113	113	Ambler	1	Monday	) 65 and olde	75.1	2	May-00	NO
Latest 1	Ambler #000114	114	Ambler	1	Saturday	(b) 5 to 18	7.3	2	May-00	NO
Latest 1	Ambler #000115	115	Ambler	1	Saturday	(b) 5 to 18	7.3	2	May-00	NO
Latest 1	Ambler #000116	116	Ambler	1	Friday	(b) 5 to 18	9.1	4	May-00	YES
Latest 1	Ambler #000117	117	Ambler	1	Friday	(b) 5 to 18	7.3	2	May-00	NO
Latest 1	Ambler #000118	118	Ambler	1	Thursday	(b) 5 to 18	8.2	2	Jun-00	NO

Latest 1	Ambler #000119	119	Ambler	1	Monday	(b) 5 to 18	10.8	4	Jun-00	NO
Latest 1	Ambler #000120	120	Ambler	1	Saturday	(b) 5 to 18	4.1	4	Jun-00	NO
Latest 1	Ambler #000121	121	Ambler	1	Wednesday	(c) 19 to 44	25.6	2	Jun-00	NO
Latest 1	Ambler #000122	122	Ambler	1	Thursday	(a) 0 to 4	1.8	2	Jun-00	NO
Latest 1	Ambler #000123	123	Ambler	1	Thursday	(b) 5 to 18	11.0	5	Jul-00	NO
Latest 1	Ambler #000124	124	Ambler	1	Friday	(b) 5 to 18	12.5	3	Jul-00	NO
Latest 1	Ambler #000125	125	Ambler	1	Monday	(b) 5 to 18	10.4	2	Jul-00	NO
Latest 1	Ambler #000126	126	Ambler	1	Wednesday	(b) 5 to 18	8.1	1	Jul-00	NO
Latest 1	Ambler #000127	127	Ambler	1	Thursday	(b) 5 to 18	10.2	2	Jul-00	NO
Latest 1	Ambler #000128	128	Ambler	1	Wednesday	(c) 19 to 44	37.5	2	Aug-00	NO
Latest 1	Ambler #000129	129	Ambler	1	Monday	(c) 19 to 44	37.7	2	Aug-00	NO
Latest 1	Ambler #000130	130	Ambler	1	Monday	(b) 5 to 18	17.7	2	Aug-00	NO
Latest 1	Ambler #000131	131	Ambler	1	Wednesday	(d) 45 to 64	63.9	3	Aug-00	NO
Latest 1	Ambler #000132	132	Ambler	1	Thursday	(b) 5 to 18	14.9	2	Aug-00	NO
Latest 1	Ambler #000133	133	Ambler	1	Friday	(c) 19 to 44	37.7	2	Aug-00	NO
Latest 1	Ambler #000134	134	Ambler	1	Monday	(b) 5 to 18	9.8	3	Aug-00	NO
Latest 1	Ambler #000135	135	Ambler	1	Tuesday	(c) 19 to 44	40.2	3	Aug-00	NO
Latest 1	Ambler #000136	136	Ambler	1	Monday	(c) 19 to 44	40.3	3	Aug-00	NO
Latest 1	Ambler #000137	137	Ambler	1	Tuesday	(b) 5 to 18	8.1	3	Aug-00	NO
Latest 1	Ambler #000141	141	Ambler	1	Wednesday	(b) 5 to 18	16.2	2	Aug-00	NO
Latest 1	Ambler #000142	142	Ambler	1	Tuesday	(b) 5 to 18	12.2	6	Sep-00	NO
Latest 1	Ambler #000143	143	Ambler	1	Wednesday	(c) 19 to 44	20.7	3	Sep-00	NO
Latest 1	Ambler #000144	144	Ambler	1	Tuesday	(b) 5 to 18	11.7	3	Sep-00	NO
Latest 1	Ambler #000145	145	Ambler	1	Friday	(d) 45 to 64	60.4	3	Sep-00	NO
Latest 1	Ambler #000146	146	Ambler	1	Friday	(b) 5 to 18	7.4	2	Sep-00	NO
Latest 1	Ambler #000147	147	Ambler	1	Wednesday	(c) 19 to 44	37.0	2	Oct-00	YES
Latest 1	Ambler #000149	149	Ambler	1	Wednesday	(b) 5 to 18	16.3	2	Oct-00	NO
Latest 1	Ambler #000150	150	Ambler	1	Tuesday	(b) 5 to 18	12.0	4	Oct-00	NO
Latest 1	Ambler #000151	151	Ambler	1	Monday	(b) 5 to 18	4.9	2	Oct-00	NO
Latest 1	Ambler #000152	152	Ambler	1	Monday	(a) 0 to 4	4.0	2	Oct-00	NO
Latest 1	Ambler #000153	153	Ambler	1	Thursday	) 65 and olde	79.3	3	Nov-00	NO
Latest 1	Ambler #000154	154	Ambler	1	Thursday	(c) 19 to 44	37.8	4	Nov-00	NO
Latest 1	Ambler #000155	155	Ambler	1	Monday	(a) 0 to 4	1.6	2	Nov-00	NO
Latest 1	Ambler #000156	156	Ambler	1	Monday	(b) 5 to 18	10.5	3	Nov-00	YES
Latest 1	Ambler #000157	157	Ambler	1	Monday	(c) 19 to 44	24.1	4	Nov-00	YES

Latest 1	Ambler #000158	158	Ambler	1	Thursday	(b) 5 to 18	16.5	2	Nov-00	NO
Latest 1	Ambler #000159	159	Ambler	1	Monday	(b) 5 to 18	7.8	5	Dec-00	YES
Latest 1	Ambler #000160	160	Ambler	1	Tuesday	(b) 5 to 18	8.7	3	Dec-00	NO

Digital Camera Used	(1) Ear Injury	(1) AOM	(1) COM	(1) SOM	(1) Ear Canal Infection	(1) Object in Ear	(1) Hearing Loss	(1) Other	(1) Ear Diagnosis	(1) Completed Assessment Details
NO								BILATERAL	1	NON BLANK
NO								BILATERAL	1	NON BLANK
NO		RIGHT	LEFT						2	NON BLANK
NO								BILATERAL	1	NON BLANK
NO								BILATERAL	1	NON BLANK
NO								BILATERAL	1	NON BLANK
NO								BILATERAL	1	NON BLANK
NO		BILATERAL							1	NON BLANK
YES								BILATERAL	1	NON BLANK
YES								BILATERAL	1	NON BLANK
YES								BILATERAL	1	NON BLANK
YES								BILATERAL	1	NON BLANK
YES								BILATERAL	1	NON BLANK
NO								LEFT	1	NON BLANK
YES									0	NON BLANK
YES								BILATERAL	1	NON BLANK
YES									0	NON BLANK
YES									0	NON BLANK
NO								BILATERAL	1	NON BLANK
NO		BILATERAL							1	NON BLANK
NO								LEFT	1	NON BLANK
NO								LEFT	1	NON BLANK
YES									0	NON BLANK
YES									0	NON BLANK
YES									0	NON BLANK
NO									0	NON BLANK
NO			BILATERAL						1	NON BLANK
YES									0	NON BLANK
YES									0	
YES									0	NON BLANK
NO			LEFT					RIGHT	2	NON BLANK

4.6

YES			BILATERAL	1	NON BLANK
NO			LEFT	1	NON BLANK
NO			BILATERAL	1	NON BLANK
NO			BILATERAL	1	NON BLANK
YES			BILATERAL	1	NON BLANK
YES			BILATERAL	1	NON BLANK
YES			BILATERAL	1	NON BLANK
NO			BILATERAL	1	NON BLANK
YES				0	NON BLANK
YES			BILATERAL	1	NON BLANK
YES			BILATERAL	1	NON BLANK
YES				0	NON BLANK
NO	RIGHT			1	
NO		LEFT		1	
YES				0	NON BLANK
YES			BILATERAL	1	NON BLANK
YES				0	NON BLANK
YES			BILATERAL	1	NON BLANK
YES			BILATERAL	1	NON BLANK
YES				0	NON BLANK
YES			BILATERAL	1	NON BLANK
YES			BILATERAL	1	NON BLANK
YES			BILATERAL	1	NON BLANK
YES			BILATERAL	1	NON BLANK
NO	RIGHT			1	NON BLANK
YES			BILATERAL	1	NON BLANK
YES				0	NON BLANK
YES			BILATERAL	1	NON BLANK
YES			BILATERAL	1	NON BLANK
YES			BILATERAL	1	NON BLANK
YES			BILATERAL	1	NON BLANK
YES			BILATERAL	1	NON BLANK
NO			BILATERAL	1	NON BLANK
YES			BILATERAL	1	NON BLANK
NO		RIGHT		1	NON BLANK

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NO	LEFT		1	NON BLANK
NO	LEFT		1	NON BLANK
YES		BILATERAL	1	NON BLANK
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YES		BILATERAL	1	NON BLANK
YES			0	NON BLANK
YES		BILATERAL	1	NON BLANK
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YES		BILATERAL	1	NON BLANK
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YES		BILATERAL	1	NON BLANK
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YES		BILATERAL	1	NON BLANK
NO	LEFT		1	NON BLANK
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YES		BILATERAL	1	NON BLANK
YES		BILATERAL	1	NON BLANK
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YES			0	NON BLANK
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YES		BILATERAL	1	NON BLANK

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YES			0	NON BLANK
YES		BILATERAL	1	NON BLANK
YES		BILATERAL	1	NON BLANK
YES			0	NON BLANK
YES		BILATERAL	1	NON BLANK
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YES		BILATERAL	1	NON BLANK
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YES		BILATERAL	1	NON BLANK
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YES			0	NON BLANK
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YES			0	NON BLANK
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YES		BILATERAL	1	NON BLANK
YES		BILATERAL	1	NON BLANK
YES			0	NON BLANK
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YES		BILATERAL	1	NON BLANK
YES			0	NON BLANK
YES		BILATERAL	1	NON BLANK
YES		BILATERAL	1	NON BLANK
YES		BILATERAL	1	NON BLANK
YES			0	NON BLANK
YES		BILATERAL	1	NON BLANK
NO		RIGHT	1	NON BLANK
NO	LEFT		1	NON BLANK

4.9

YES				0	NON BLANK
NO	RIGHT			1	
YES			BILATERAL	1	NON BLANK

(1) Completed Treatment Plan	(1) Completed Follow Up	(1) Provider FullName	(1) Provider Education	(1) Provider AGE	(1) Provider Years Experience	(2) Agree with (1)
		Ambler 1	CHA III	26	2	No Comment / Other
NON BLANK		Ambler 1	CHA III	26	2	No Comment / Other
NON BLANK		Ambler 1	CHA III	26	2	No Comment / Other
NON BLANK		Ambler 1	CHA III	26	2	
NON BLANK		Ambler 1	CHA III	26	2	Agree
NON BLANK		Ambler 1	CHA III	26	2	Agree
NON BLANK		Ambler 2	CHP	43	22	No Comment / Other
NON BLANK		Ambler 1	CHA III	26	2	
NON BLANK		Ambler 1	CHA III	26	2	No Comment / Other
NON BLANK		Ambler 1	CHA III	26	2	No Comment / Other
NON BLANK		Ambler 1	CHA III	26	2	
NON BLANK		Ambler 1	CHA III	26	2	
NON BLANK		Ambler 1	CHA III	26	2	
NON BLANK		Ambler 2	CHP	43	23	
		Ambler 1	CHA III	26	2	
NON BLANK		Ambler 1	CHA III	26	2	
NON BLANK		Ambler 1	CHA III	26	2	
NON BLANK	NON BLANK	Ambler 3		20		Agree
NON BLANK		Ambler 1	CHA III	26	2	No Comment / Other
NON BLANK		Ambler 2	CHP	43	22	
		Kotzebue 1		34		No Comment / Other
NON BLANK		Ambler 3		20		
NON BLANK		Ambler 2	CHP	43	23	
NON BLANK		Ambler 3		20		No Comment / Other
		Ambler 2	CHP	43	23	
		Ambler 2	CHP	43	23	No Comment / Other
		Ambler 2	CHP	43	23	
		Ambler 3		21		
		Selawik 1	CHA IV	27	4	
NON BLANK		Ambler 2	CHP	43	23	
		Ambler 3		21		

NON BLANK	NON BLANK	Ambler 2	CHP	43	23	
NON BLANK	NON BLANK	Ambler 3		21		No Comment / Other
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NON BLANK		Ambler 1	CHA III	27	2	
NON BLANK		Ambler 1	CHA III	27	2	
NON BLANK		Ambler 1	CHA III	27	2	
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NON BLANK		Ambler 1	CHA III	27	2	
NON BLANK		Ambler 1	CHA III	27	2	
NON BLANK		Ambler 2	CHP	43	23	
NON BLANK		Ambler 1	CHA III	27	2	
		Ambler 2	CHP	43	23	
NON BLANK		Ambler 2	CHP	44	23	
		Ambler 2	CHP	44	23	
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NON BLANK		Ambler 1	CHA III	27	3	
NON BLANK		Ambler 2	CHP	44	23	
NON BLANK		Ambler 1	CHA III	27	3	
NON BLANK		Ambler 1	CHA III	27	3	
NON BLANK		Ambler 1	CHA III	27	3	
NON BLANK		Ambler 1	CHA III	27	3	
NON BLANK		Ambler 2	CHP	44	23	
NON BLANK		Ambler 1	CHA III	27	3	
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NON BLANK		Ambler 1	CHA III	27	3	
NON BLANK		Ambler 1	CHA III	27	3	
NON BLANK		Ambler 1	CHA III	27	3	
NON BLANK		Ambler 1	CHA III	27	3	
NON BLANK		Ambler 1	CHA III	27	3	
NON BLANK		Ambler 1	CHA III	27	3	
NON BLANK		Ambler 1	CHA III	27	3	

4.12

NON BLANK	Ambler 2	CHP	44	23
NON BLANK	Ambler 1	CHA III	27	3
NON BLANK	Ambler 1	CHA III	27	3
NON BLANK	Ambler 2	CHP	44	23
NON BLANK	Ambler 1	CHA III	27	3
NON BLANK	Ambler 1	CHA III	27	3
NON BLANK	Ambler 1	CHA III	27	3
NON BLANK	Ambler 1	CHA III	27	3
	Ambler 2	CHP	44	23
NON BLANK	Ambler 1	CHA III	27	3
NON BLANK	Ambler 1	CHA III	27	3
NON BLANK	Ambler 1	CHA III	27	3
NON BLANK	Ambler 1	CHA III	27	3
NON BLANK	Ambler 1	CHA III	27	3
NON BLANK	Ambler 2	CHP	44	23
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	Ambler 2	CHP	44	23
NON BLANK	Ambler 1	CHA III	27	3
NON BLANK	Ambler 1	CHA III	27	3
NON BLANK	Ambler 1	CHA III	27	3
NON BLANK	Ambler 1	CHA III	27	3
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NON BLANK	Ambler 1	CHA III	27	3
NON BLANK	Ambler 1	CHA III	27	3
NON BLANK	Ambler 1	CHA III	27	3
NON BLANK	Ambler 1	CHA III	27	3
	Ambler 2	CHP	44	24
	Ambler 2	CHP	44	24
	Ambler 2	CHP	44	24
	Ambler 3		21	
	Ambler 1	CHA III	27	3
NON BLANK	Ambler 2	CHP	44	24
NON BLANK	Ambler 1	CHA III	27	3

NON BLANK	Ambler 2	CHP	44	24
	Ambler 2	CHP	44	24
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NON BLANK	Ambler 1	CHA III	27	3
	Ambler 1	CHA III	27	3
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NON BLANK	Ambler 1	CHA III	27	3
NON BLANK	Ambler 1	CHA III	27	3
NON BLANK	Ambler 1	CHA III	27	3
NON BLANK	Ambler 1	CHA III	28	3
NON BLANK	Ambler 1	CHA III	28	3
NON BLANK	Ambler 1	CHA III	28	3
NON BLANK	Ambler 1	CHA III	28	3
NON BLANK	Ambler 1	CHA III	28	3
NON BLANK	Ambler 1	CHA III	28	3
	Ambler 2	CHP	44	24
	Ambler 2	CHP	44	24
	Ambler 2	CHP	44	24
	Ambler 2	CHP	44	24
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NON BLANK	Ambler 4		32	
	Ambler 5		43	
NON BLANK	Ambler 5		43	
NON BLANK	Ambler 5		43	
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NON BLANK	Ambler 5		43	
	Ambler 4		32	
NON BLANK	Ambler 1	CHA III	28	3
NON BLANK	Ambler 1	CHA III	28	3
NON BLANK	Ambler 1	CHA III	28	4
	Ambler 2	CHP	45	24
NON BLANK	Ambler 1	CHA III	28	4
NON BLANK	Ambler 4		32	
NON BLANK	Ambler 4		32	

	Ambler 2	CHP	45	24
	Ambler 2	CHP	45	24
NON BLANK	Ambler 4		32	

Patient Sex	EMAIL Size	EMAIL Received Time	EMAIL # Attachments Otoscope	EMAIL # Attachments NOT Otoscope	EMAIL # Attachments UNKNOWN Otoscope	EMAIL # Attachments (.CMP)	Patient Private
Female	138159	3/25/1999 15:46	4	0	0	0	FALSE
Male	138371	2/4/1999 19:25	7	0	0	7	FALSE
Male	61542	4/27/1999 13:55	1	0	0	0	FALSE
Male	230492	4/28/1999 14:26	4	0	0	0	FALSE
Male	58453	2/4/1999 16:21	2	0	0	2	FALSE
Male	54921	2/5/1999 18:15	2	0	0	2	FALSE
Female	84444	2/8/1999 23:43	4	0	0	4	FALSE
Male	65168	5/5/1999 14:03	1	0	0	0	FALSE
Male	164065	2/11/1999 16:38	0	3	0	0	FALSE
Female	171896	5/6/1999 14:13	0	4	0	0	FALSE
Male	102064	5/7/1999 17:34	0	2	0	0	FALSE
Female	116744	5/17/1999 10:02	0	2	0	0	FALSE
Female	188580	5/24/1999 14:15	0	4	0	0	FALSE
Female	216174	5/28/1999 11:50	7	0	0	0	FALSE
Female	263275	6/7/1999 14:31	0	6	0	0	FALSE
Male	118882	6/8/1999 15:14	0	2	0	0	FALSE
Female	200300	6/9/1999 9:49	0	5	0	0	FALSE
	130471	6/23/1999 16:09	0	2	0	0	FALSE
Male	74604	3/12/1999 14:39	2	0	0	2	FALSE
Male	76117	3/23/1999 9:26	3	0	0	3	FALSE
Female	163230	6/24/1999 10:23	5	0	0	0	FALSE
Female	184169	6/24/1999 11:38	6	0	0	0	FALSE
Female	180787	7/1/1999 14:35	0	3	0	0	FALSE
Female	162850	7/2/1999 15:38	0	4	0	0	FALSE
Female	197284	7/6/1999 14:34	0	4	0	0	FALSE
Female	95451	7/6/1999 17:52	2	0	0	0	FALSE
Male	183709	7/14/1999 11:48	6	0	0	0	FALSE
Male	271365	7/26/1999 14:13	0	5	0	0	FALSE
Male	106469	7/27/1999 13:43	0	2	0	0	FALSE
Male	133255	7/27/1999 14:39	0	3	0	0	FALSE
Male	206828	8/9/1999 11:10	6	0	0	0	FALSE

Female	357541	9/1/1999 10:43	0	7	0	0	FALSE
Male	253616	9/2/1999 14:44	7	0	0	0	FALSE
Female	177225	9/8/1999 14:32	3	0	0	0	FALSE
Male	319461	9/9/1999 14:05	6	0	0	0	FALSE
Male	232254	9/13/1999 9:57	0	6	0	0	FALSE
Female	174180	9/13/1999 10:08	0	3	0	0	FALSE
Male	169464	9/17/1999 15:59	0	4	0	0	FALSE
Male	140548	9/20/1999 14:37	4	0	0	0	FALSE
Male	264085	9/20/1999 16:43	0	6	0	0	FALSE
Male	148915	9/23/1999 11:02	0	3	0	0	FALSE
Male	200155	9/24/1999 15:51	0	5	0	0	FALSE
Male	181821	9/25/1999 18:16	0	3	0	0	FALSE
Female	193504	10/5/1999 11:05	6	0	0	0	FALSE
Female	216085	10/5/1999 11:52	6	0	0	0	FALSE
Male	166866	10/8/1999 15:41	0	3	0	0	FALSE
Male	209708	10/22/1999 13:31	0	4	0	0	FALSE
Female	149855	10/27/1999 14:24	0	3	0	0	FALSE
Female	165964	10/28/1999 10:19	0	3	0	0	FALSE
Male	170394	10/28/1999 17:02	0	4	0	0	FALSE
Male	147665	11/4/1999 10:42	0	3	0	0	FALSE
Male	184642	11/9/1999 16:02	0	3	0	0	FALSE
Female	159409	11/15/1999 17:00	0	3	0	0	FALSE
Female	193845	11/16/1999 16:41	0	4	0	0	FALSE
Male	322368	11/17/1999 10:01	0	7	0	0	FALSE
Female	237778	11/18/1999 11:12	7	0	0	0	FALSE
Female	134818	11/18/1999 15:05	0	2	0	0	FALSE
Male	174661	11/22/1999 10:02	0	4	0	0	FALSE
Female	168945	12/2/1999 11:55	0	2	0	0	FALSE
Male	176274	12/2/1999 15:18	0	3	0	0	FALSE
Male	204973	12/3/1999 15:16	0	4	0	0	FALSE
Female	82003	12/6/1999 11:12	0	1	0	0	FALSE
Female	195799	12/6/1999 11:18	0	4	0	0	FALSE
Male	176873	12/13/1999 11:24	3	0	0	0	FALSE
Male	85269	12/17/1999 10:07	0	1	0	0	FALSE
Female	240669	1/4/2000 11:57	3	0	0	0	FALSE

Female	396520	1/6/2000 13:45	7	0	0	0	FALSE
Female	224550	1/7/2000 10:22	4	0	0	0	FALSE
Female	173836	1/7/2000 16:19	3	0	0	0	FALSE
Male	164898	1/10/2000 14:03	0	3	0	0	FALSE
Female	160900	1/24/2000 11:15	3	0	0	0	FALSE
Female	216599	2/11/2000 9:26	0	4	0	0	FALSE
Male	280902	2/18/2000 15:02	0	6	0	0	FALSE
Female	102462	2/28/2000 16:34	0	2	0	0	FALSE
Female	187757	2/29/2000 14:40	0	3	0	0	FALSE
Male	255849	3/8/2000 15:10	0	5	0	0	FALSE
Female	246683	3/9/2000 14:08	0	5	0	0	FALSE
Male	188940	3/10/2000 8:43	0	4	0	0	FALSE
Female	179474	3/10/2000 11:05	0	3	0	0	FALSE
Female	251990	3/14/2000 20:48	0	4	0	0	FALSE
Female	221311	3/23/2000 8:52	0	4	0	0	FALSE
Male	181526	4/4/2000 8:44	0	3	0	0	FALSE
Male	267272	4/5/2000 14:40	0	6	0	0	FALSE
Female	154947	4/11/2000 10:31	0	3	0	0	FALSE
Male	175302	4/17/2000 9:11	0	3	0	0	FALSE
Male	219682	4/20/2000 21:51	6	1	0	0	FALSE
Male	155957	4/21/2000 10:33	0	3	0	0	FALSE
Male	77371	4/21/2000 10:55	0	1	0	0	FALSE
Female	156165	4/24/2000 10:51	0	3	0	0	FALSE
Female	90490	4/24/2000 11:49	0	1	0	0	FALSE
Male	184600	4/24/2000 14:20	3	0	0	0	FALSE
Male	150392	4/25/2000 13:29	0	3	0	0	FALSE
Female	193450	4/25/2000 16:26	0	3	0	0	FALSE
Female	117681	5/5/2000 13:43	0	2	0	0	FALSE
Female	80309	5/15/2000 15:49	0	1	0	0	FALSE
Male	117632	5/15/2000 16:05	0	2	0	0	FALSE
Male	138799	5/20/2000 20:45	0	2	0	0	FALSE
Male	143449	5/20/2000 21:06	0	2	0	0	FALSE
Male	199483	5/26/2000 13:31	4	0	0	0	FALSE
Male	99586	5/26/2000 13:43	0	2	0	0	FALSE
Female	106437	6/1/2000 10:43	0	2	0	0	FALSE

Female	190339	6/5/2000 14:37	0	4	0	0	FALSE
Female	168340	6/10/2000 13:47	0	4	0	0	FALSE
Male	91818	6/14/2000 13:25	0	2	0	0	FALSE
Male	114830	6/22/2000 13:38	0	2	0	0	FALSE
Female	247395	7/20/2000 13:32	0	5	0	0	FALSE
Male	175428	7/21/2000 13:18	0	3	0	0	FALSE
Female	135482	7/24/2000 15:25	0	2	0	0	FALSE
Female	76853	7/26/2000 13:44	0	1	0	0	FALSE
Male	127458	7/27/2000 14:00	0	2	0	0	FALSE
Male	158264	8/2/2000 10:00	0	2	0	0	FALSE
Male	132410	8/7/2000 8:49	0	2	0	0	FALSE
Male	104210	8/7/2000 13:17	0	2	0	0	FALSE
Male	161935	8/9/2000 11:46	0	3	0	0	FALSE
Female	107593	8/10/2000 11:04	0	2	0	0	FALSE
Male	132756	8/11/2000 9:16	0	2	0	0	FALSE
Female	158142	8/14/2000 11:01	0	3	0	0	FALSE
Male	172240	8/15/2000 14:11	0	3	0	0	FALSE
Male	151060	8/21/2000 10:15	0	3	0	0	FALSE
Male	134522	8/22/2000 9:01	0	3	0	0	FALSE
Female	133058	8/30/2000 10:13	0	2	0	0	FALSE
Female	317621	9/5/2000 15:30	0	6	0	0	FALSE
Male	148942	9/13/2000 10:04	0	3	0	0	FALSE
Female	156843	9/19/2000 14:57	0	3	0	0	FALSE
Female	148923	9/29/2000 9:10	0	3	0	0	FALSE
Female	115894	9/29/2000 9:48	0	2	0	0	FALSE
Female	83087	10/4/2000 12:11	2	0	0	0	FALSE
Female	116908	10/4/2000 13:46	0	2	0	0	FALSE
Male	161858	10/10/2000 9:45	0	4	0	0	FALSE
Female	120861	10/23/2000 10:38	0	2	0	0	FALSE
Male	112941	10/23/2000 10:43	0	2	0	0	FALSE
Female	139691	11/2/2000 10:04	0	3	0	0	FALSE
Male	180990	11/2/2000 14:24	0	4	0	0	FALSE
Male	112423	11/6/2000 10:00	0	2	0	0	FALSE
Female	109062	11/20/2000 14:02	3	0	0	0	FALSE
Male	146141	11/27/2000 16:55	4	0	0	0	FALSE

Female	120743	11/30/2000 19:56	0	2	0	0	FALSE
Female	190525	12/4/2000 11:06	5	0	0	0	FALSE
Female	166829	12/26/2000 14:24	0	3	0	0	FALSE

Alaska Health Resources LLC
3001 Madison Way
Anchorage, Alaska 99508

Fred Pearce PhD
Applied Science Lab
Building K
University of Alaska Anchorage
3211 Providence Drive
Anchorage,Alaska 99508

Dear Dr Pearce:

The clinic staff in Valdez decided not to participate in telemedicine study in Alaska. They never sent an encounter in the approximately 6 months they had equipment; they did occasionally use the unit for patient education. They returned the equipment to Alaska Health Resources so it could be used by a clinic interested in participating in the study of telemedicine.

KT Melican FNP, the owner of the Alaska Health Care Clinic was contacted, and the equipment has been deployed to her site at 3600 Minnesota, Anchorage. I installed the equipment on 1/24/02, gave a brief orientation to the use of the equipment, emphasizing the use, and care, of the otoscope. I will return in a couple weeks to demonstrate use of the efficacy project forms, and answer questions that they may have after having used the otoscope.

Equipment returned from Valdez, and deployed to Alaska Health Care Clinic.
Micron CPU: serial number: 2888301-0001Windows NT : 06601-OEM-0001931-03319
Monitor serial number: 9026113
AMD otoscope: box number: EN 101650 Otoscope number: H19020580 AMD1
Sony Mavica camera: 107820

Equipment not returned from Valdez:
UPS
Cart
Printer

Alaska Health Resources provided a cart for the equipment

The clinicians participating in the Efficacy Trial Project are very appreciative of the work you have done to deploy telemedicine to the private sector. We anticipate gathering even more valuable information as the Efficacy Project continues through September 2002.

Warm regards,

Deborah Kiley FNP

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AS REQUESTED BY UAA PROPERTY:
I HAVE ASSIGNED THE FOLLOWING NUMBERS TO THE EQUIPMENT
PURCHASED FOR THE NATIONAL LIBRARY OF MEDICINE PROJECT.

EN101631/00250001 4373 02/28/2001 UNIVERSITY OF ALASKA – K154
UAA Inventory number: 199136

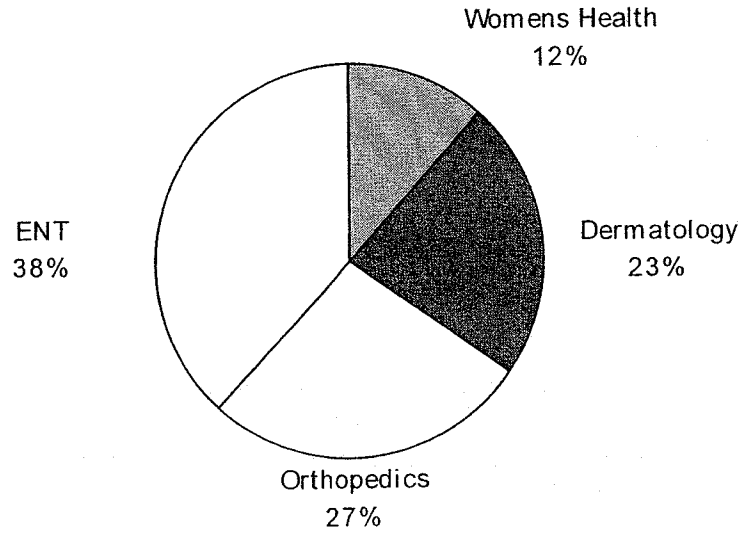
EN101650/00470008 4373 02/28/2001 UNIVERSITY OF ALASKA – Valdez
UAA Inventory number: 199137

EN101649/00470010 4373 02/28/2001 UNIVERSITY OF ALASKA – Glenallen
UAA Inventory number: 199138

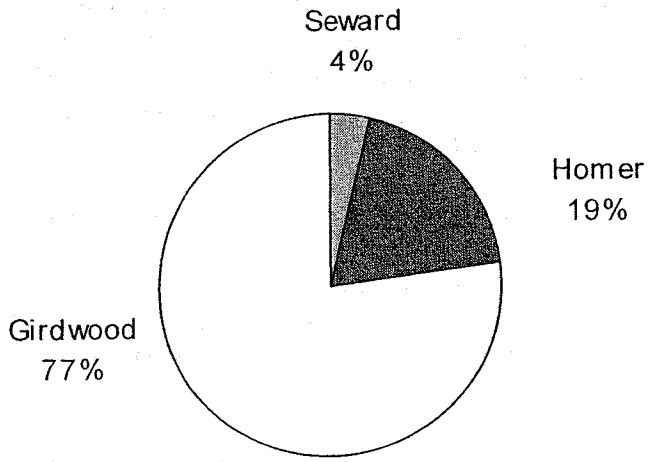
EN101671/00470007 4373 02/28/2001 UNIVERSITY OF ALASKA - Girdwood
UAA Inventory number: 199139

EN101682/00090004 4373 02/28/2001 UNIVERSITY OF ALASKA-Seward
UAA Inventory number: 199140

Encounters By Specialty



Encounters By Site of Origin



March 11, 2002

Dr. Fred Pearce, PhD
University of Alaska Anchorage
Room 154,K building
Anchorage, AK 99508

Dear Dr. Pearce,

On behalf of the Yukon-Kuskokwim Health Corporation (YKHC), I would like to express our appreciation for the opportunity to participate in the NLM/UAA Telemedicine Project. This has been a rewarding and beneficial project for the people of the Yukon Kuskokwim (Y-K) Delta, as well as for the staff of YKHC.

As a participant in the grant, YKHC installed six telemedicine carts in five rural Alaska clinics and one rural hospital. The clinics were Chevak, Hooper Bay, Kotlik, Marshall, and St Mary's. ENT images were captured and stored. It was the intent of YKHC to use this project as a trial for Telemedicine on a larger scale. The trial identified several issues which needed to be addressed before the project could be implemented in its entirety. A summary of the findings is provided below.

YKHC Overview:
YKHC is a private, non-profit health corporation that delivers primary health care, health education, preventive medicine, and health planning services to the people of the Y-K Delta. Funding for the Corporation is primarily provided through the Indian Health Service (IHS). YKHC operates as a federally designated contractor under P.L. 93-638, the Indian Self-Determination and Education Assistance Act of 1975. In January 1995, YKHC began providing health delivery services under the Alaska Tribal Health Compact, an all-Alaska tribal self-governance agreement with the IHS.

YKHC serves a population of approximately 25,000 persons in the Y-K Delta. This area covers 80,000 square miles and is accessible only by air. There are no roads or telephone land-lines. All communication is delivered via satellite or radio. There are a total of 58 tribes served by YKHC. These tribes are acknowledged through continuing Tribal Resolutions for provision of primary health care services on their behalf under the Alaska Tribal Health Compact.

Project Overview:
Six telemedicine carts were deployed and a total of 36 YKHC staff and providers were trained in use of the carts, maintenance and deployment. The carts were equipped to provide a telemedicine consult between a Community Health Aide (CHA) and a physician. The focus of the consults was

on ENT. Jesse Gunlik, was identified as the chief trainer. Mr. Gunlik has extensive experience in ENT medicine and, in Bush Alaska. His expertise was invaluable in the project. He worked with the CHAs in each of the five villages, training on computer use and ENT protocols. He also worked with the statewide project assisting in the development of culturally relevant training materials.

Although several physicians were trained to receive cases from the Community Health Aides, this part of the project was never implemented for a variety of reasons. Chief among the issues raised was the connectivity. The carts were designed to utilize low bandwidth. However, the satellite latency created additional delays in transmission. Busy providers were unable to find time for downloading and retrieving the cases at the speeds provided by dial up (usually 2400 to 4800 baud). Other issues included high provider turn-over, lack of training for new providers, under-staffed clinics and lack of time for additional referrals. No attempt was made to analyze the issues or to identify all problems.

Where we were at the end of the project:
Some decisions needed to be made at the end of the project. It was decided that the equipment should be left at the villages to be used by the Health Aides for patient education. The village CHAs discovered early in the project that patients wanted to see their own ears. The pictures from the Telemedicine carts made excellent patient education tools. It was a relief to a mother to see that her child's ear was normal. And, it also proved invaluable in describing a problem that required the child to be transported to a tertiary care center.

A second use for the carts also became evident early on. New Community Health Aides could quickly become familiar with otoscopes using the cart technology. CHAs were able to train CHAs. Visiting physicians were able to assist in training, as well. Mr. Gunlik is still using the equipment for training in those villages. The hospital equipment was moved to the Community Health Aide Program (CHAP) Training Center for use in training Health Aides in ENT protocols. The equipment is still in use at the Training Center today. Education has proved to be an effective way to increase patient satisfaction and outcomes.

The project has also provided technology education and experience for a large number of the YKHC Community Health Aides. The remote CHA has necessarily become dependent on a variety of technologies. The NLM Telemedicine carts were one of the first technology innovations to reach the clinics. CHAs have taught themselves to type using Mavis Beacon on-line instruction and have learned a number of technical skills from changing light bulbs to installing software.

Staff at YKHC are now:

1) Determining equipment to be made available to a limited number of sites at YKHC.
2) Deploying additional equipment should occur this summer, dependent upon telecommunication installations.
3) Evaluating the initial deployment and building upon the experiences.
4) Training Technology staff in installation and deployment.
5) Training additional provider staff in the use of referral cases.

Future Issues to be Addressed by YKHC:

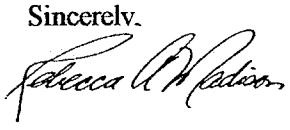
1) What future clinical resources will be required?
2) What Technology Department resources will be required for maintenance and support?
3) How much provider time is required? Will it increase Radio Medical Traffic (RMT) time?
4) How to provide on-going training in a high turn-over environment?

In summary, YKHC received a great deal of benefit from the six telemedicine carts. It was a learning experience for all involved. Some of the lessons learned included;

1) Increased knowledge of the unique environment of health care as provided under an IHS model.
2) High-end technology solutions work well in the village clinics. The CHA end users are very capable of utilizing high-end technologies.
3) Space and mobility considerations within a village clinic are very important, further study is necessary is to determine actual patient encounter use of telemedicine equipment including how technology impinges on work flow and the relationships of the people in the work space.
4) Patients in the rural villages are highly dependent on the skill of the local CHA. Further research needs to be done in relation to the "skilling" or "de-skilling" of the practioners when relying on Telemedicine referrals.
5) Good communication between the CHA and physician are critical to success. This communication is impacted by distance, culture and many other issues. Further research needs to done on the impact of the Telemedicine encounter in a cross-cultural environment with regards to trust.

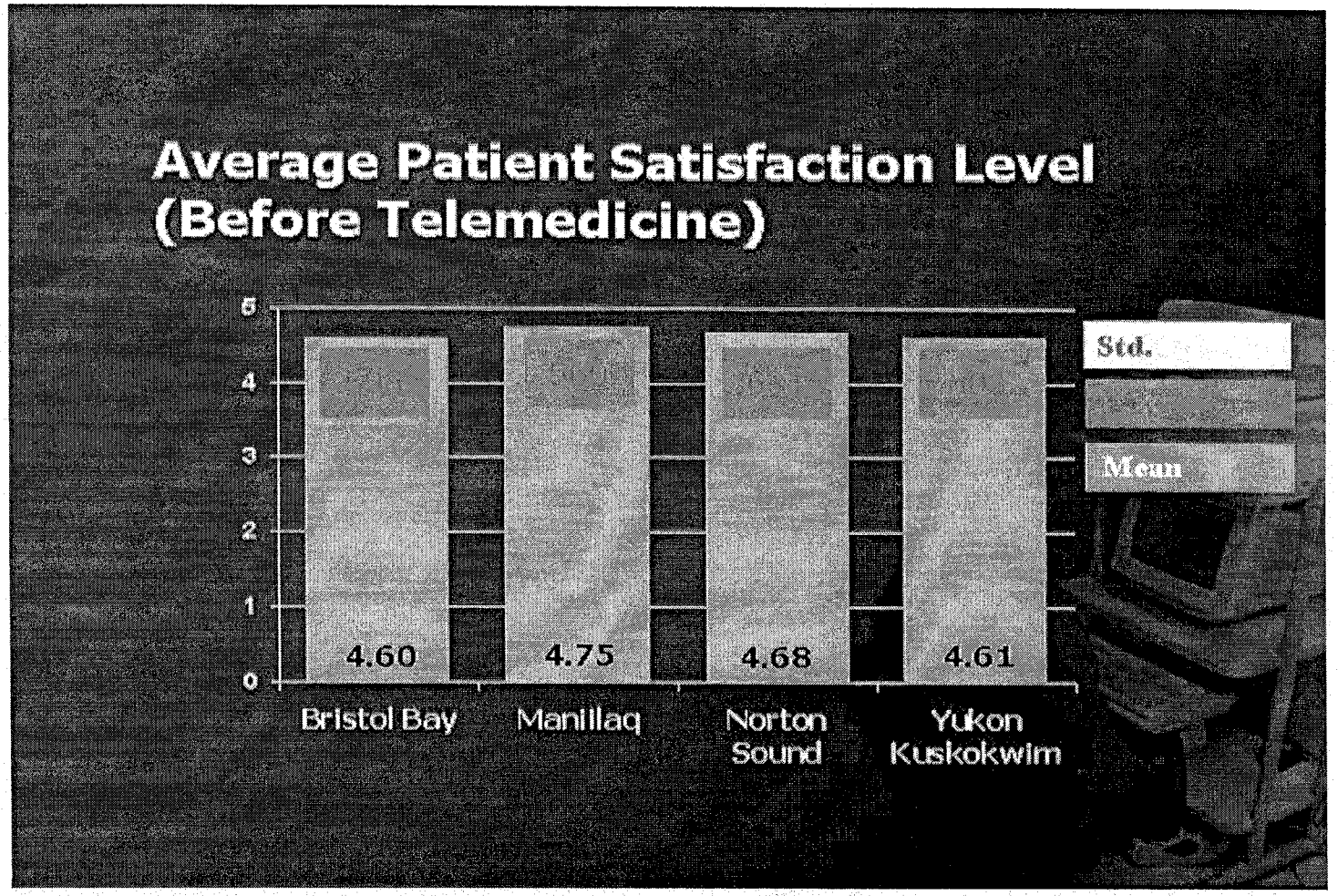
Thank you for the opportunity to participate. We look forward to working with you in the future. If you have any further questions, please do not hesitate to contact me.

Sincerely,

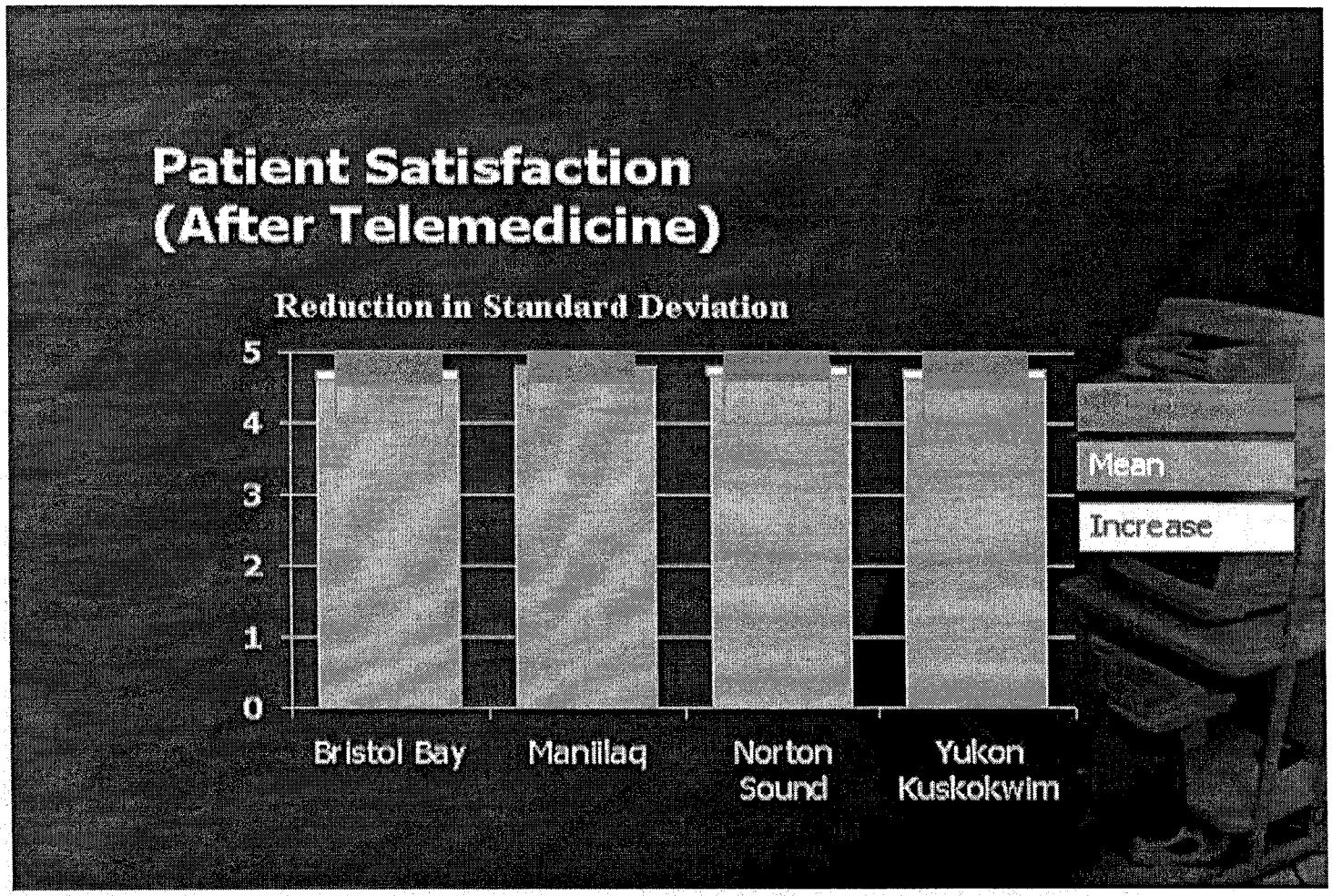


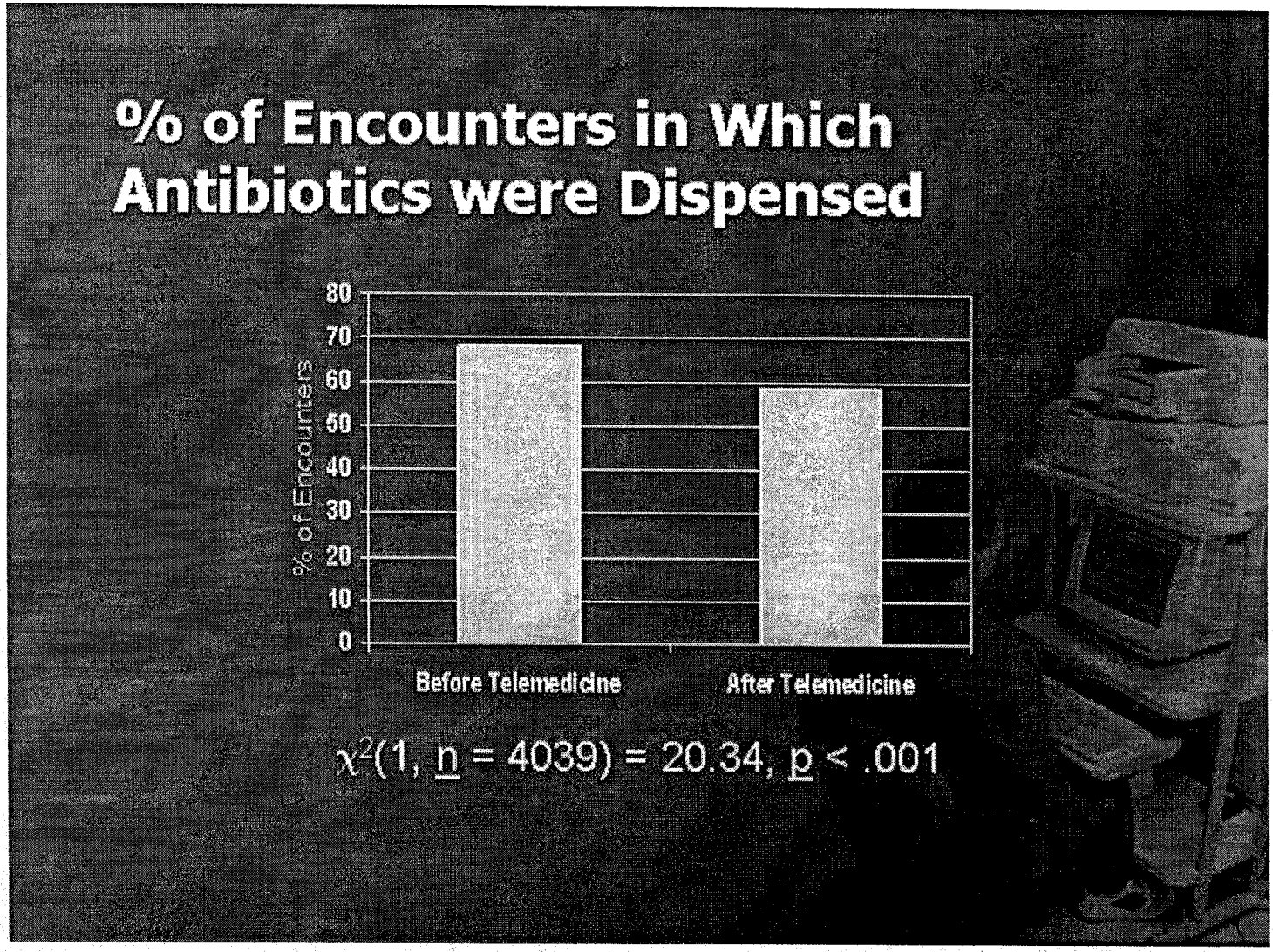
Rebecca Madison
Yukon-Kuskokwim Health Corporation
CIO
PO Box 528
Bethel, AK 99559

Ph: (907) 543-6075
rebeccamadison@starband.net

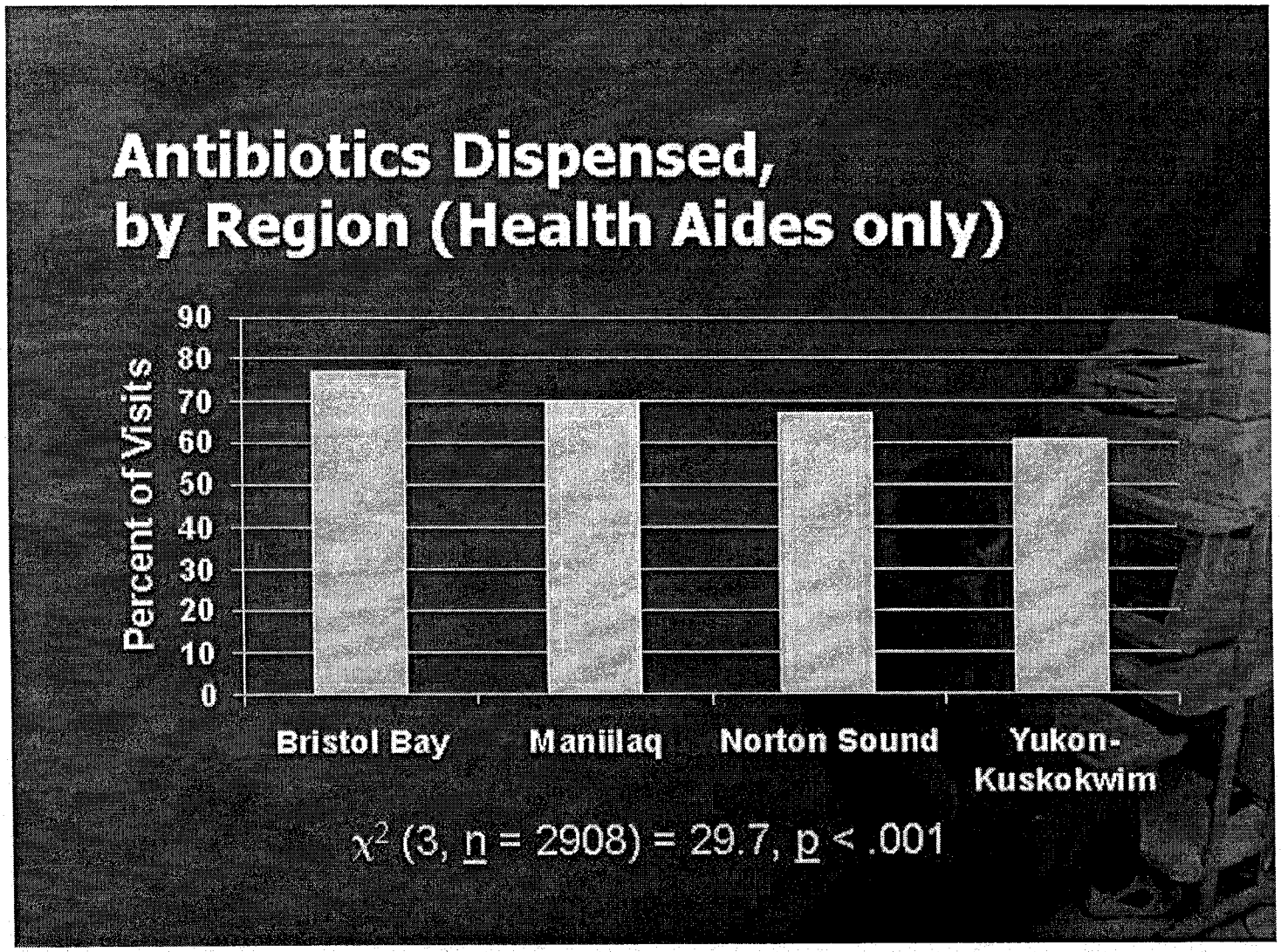

Average Patient Satisfaction Level
(Before Telemedicine)
5
4
3
2
1
0
4.60
4.75
4.68
4.61
Bristol Bay
Manillaq
Norton Sound
Yukon Kuskokwim
Std.
Mean

427

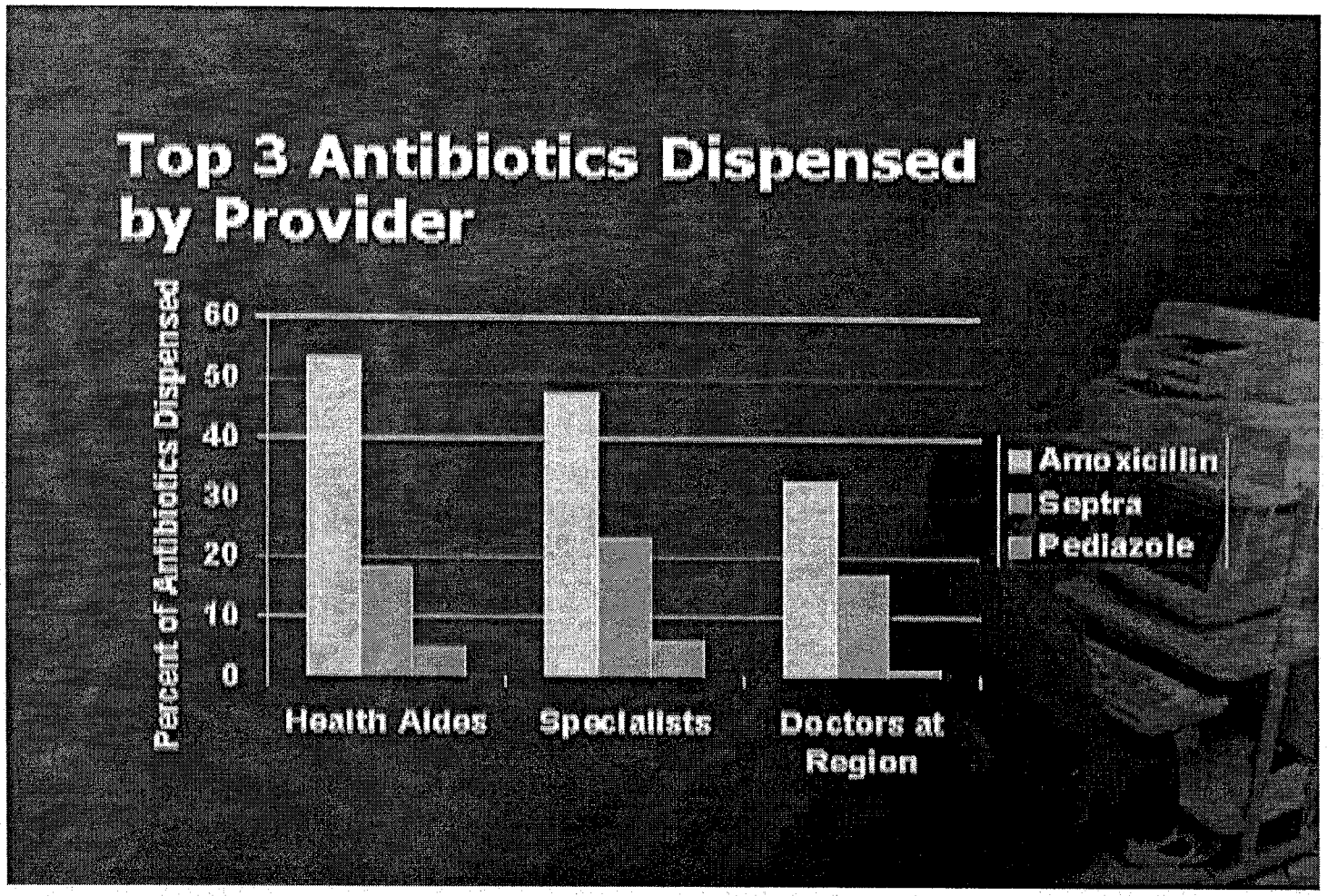

Patient Satisfaction
(After Telemedicine)
Reduction in Standard Deviation
5
4
3
2
1
0
Bristol Bay
Manillaq
Norton Sound
Yukon Kuskokwim
Mean
Increase


% of Encounters in Which Antibiotics were Dispensed
% of Encounters
80
70
60
50
40
30
20
10
0
Before Telemedicine
After Telemedicine
$\chi^2(1, \underline{n} = 4039) = 20.34, \underline{p} < .001$

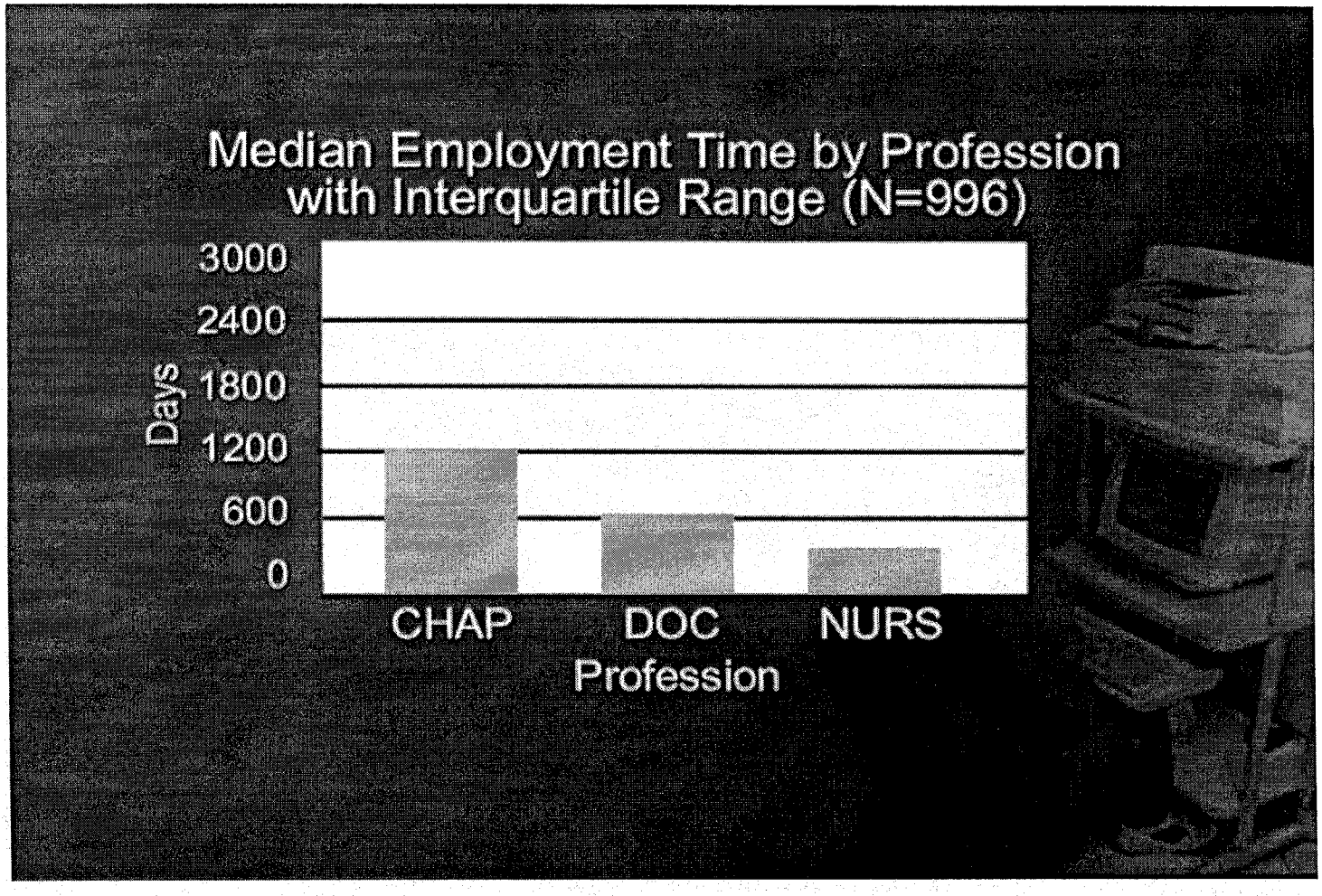
4.29


Antibiotics Dispensed,
by Region (Health Aides only)
Percent of Visits
90
80
70
60
50
40
30
20
10
0
Bristol Bay
Maniilaq
Norton Sound
Yukon-
Kuskokwim
χ^2 (3, n = 2908) = 29.7, p < .001

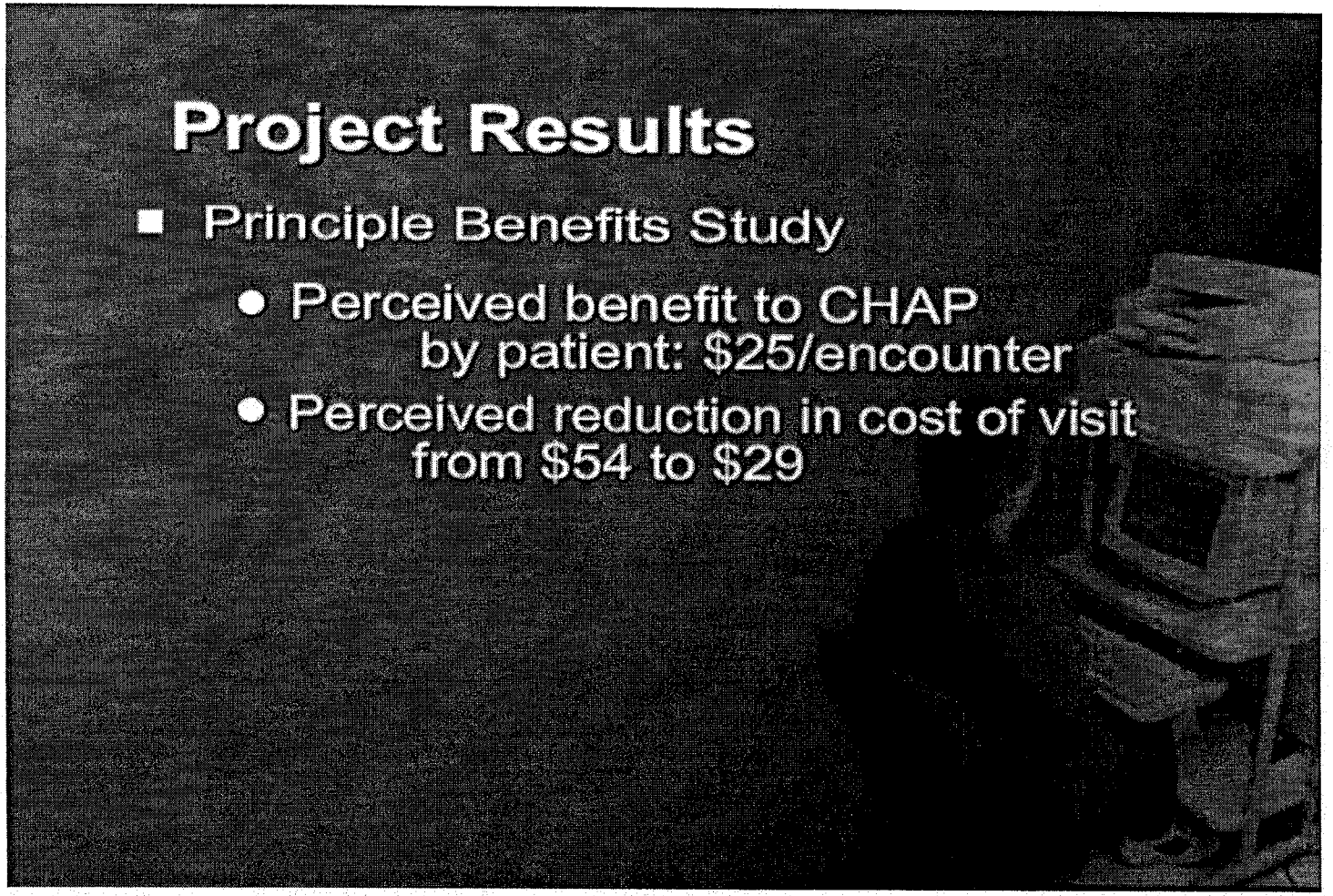
4.30


Top 3 Antibiotics Dispensed by Provider
Percent of Antibiotics Dispensed
60
50
40
30
20
10
0
Health Aides
Specialists
Doctors at Region
Amoxicillin
Septra
Pediazole

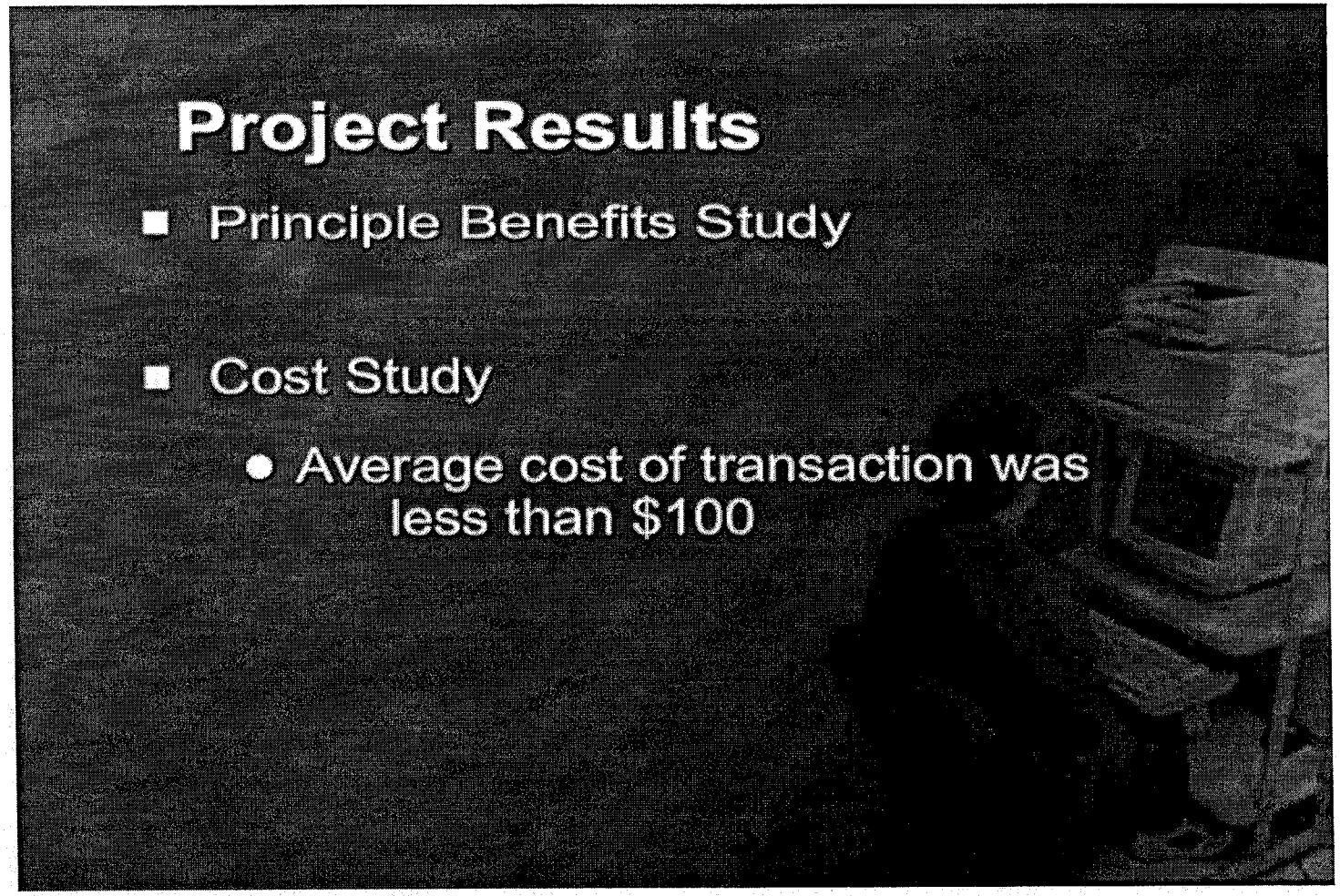
4.31

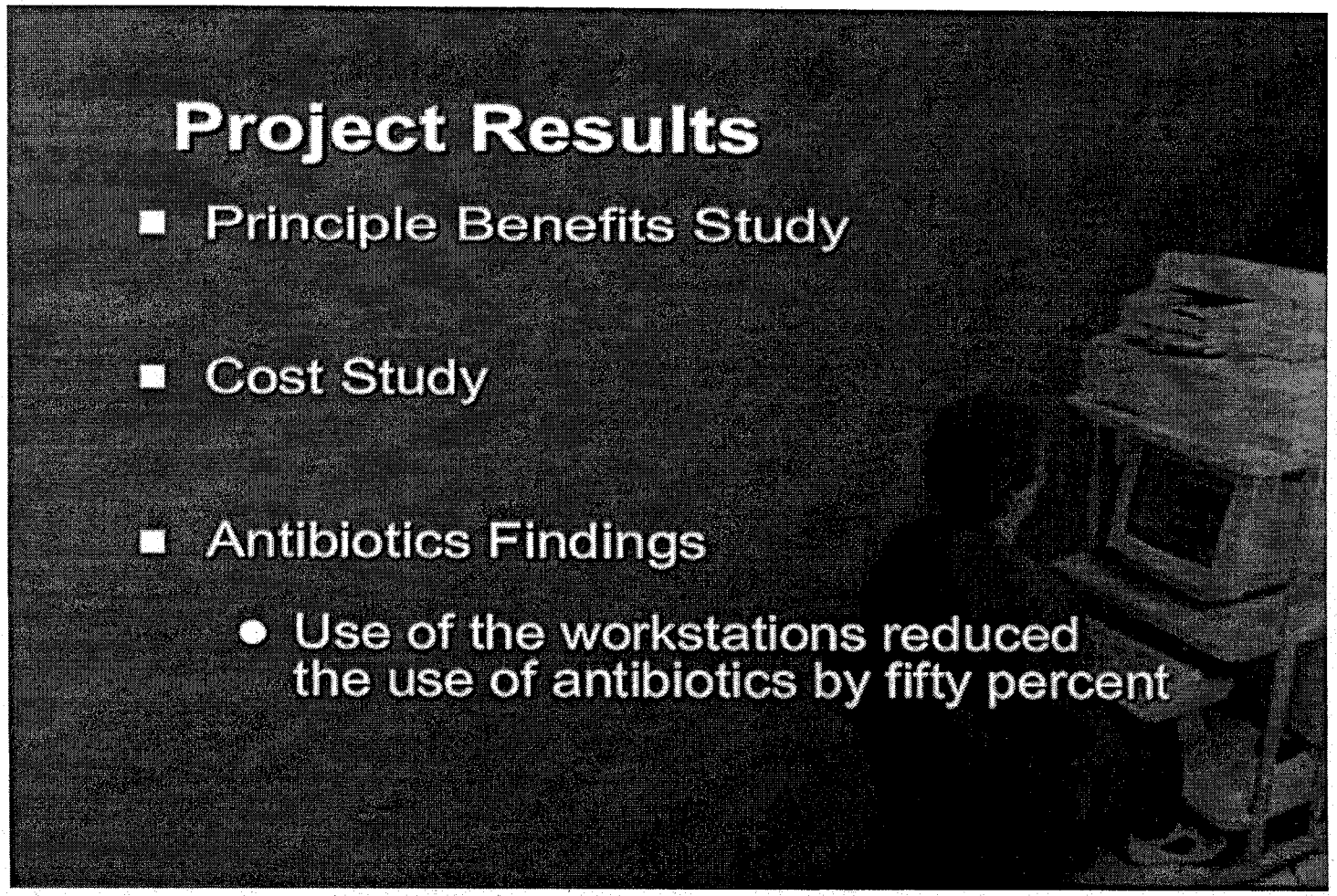

Median Employment Time by Profession
with Interquartile Range (N=996)
3000
2400
1800
1200
600
0
Days
CHAP
DOC
NURS
Profession

4.32


Project Results
Principle Benefits Study
Perceived benefit to CHAP by patient: $25/encounter
Perceived reduction in cost of visit from $54 to $29

4.33


Project Results
Principle Benefits Study
Cost Study
Average cost of transaction was less than $100


Project Results
Principle Benefits Study
Cost Study
Antibiotics Findings
Use of the workstations reduced the use of antibiotics by fifty percent

4.35

ATTP Project Successes

- Project delivered "advanced healthcare services" in an environment without roads, with great distances and low population density
- Project evaluation was able to measure changes to rural Alaska health delivery system

4.36

SERIAL NUMBERS

VILLAGE	CPU	CPU	AGP SLOT	PCI #1	PCI #3	PCI #3	ISA #2
			Matrox Millenium II	FlashBus MV Pro	3COM 3C905 NIC	3COM 3C905 NIC	US Robotics 56K V.Everything Internal Modem
	Manufacturer's Serial #	UAA #	Serial #	Serial #	Serial #	EA #	Serial #
ANMC	9558392	195826	CCM49910	IT1032575	6MN173B93B	00104B73B93B	21QR27Q7FF6L
UAA	9558391	195825	CCL03254	IT1026321	6MN173B960	00104B73B960	21QR28D7727R
KOTZEBUE	9558387	195822	ABQ57878	IT1032500	6MN173B948	00104B73B948	21QR28D77280
Ambler	9558389	195821	CCL03599	IT20005007	6MN173B95B	00104B73B95B	21QR28D77281
Buckland		n/a					
Deering		n/a					
Kiana	9558385	195823	CCL03687	IT1032565	6MN173B93A	00104B73B93A	21QR28D7728I
Kivalina		n/a					
Kobuk		n/a					
Noatak	9558386	195820	CCL03920	IT1032576	6MN173B93C	00104B73B93C	21QR28D7727V
Noorvik	9558388	195827	CCL03900	IT1032535	6MN173B937	00104B73B937	21QR28D7728V
Selawik	9558390	195824	CCL03597	IT1032501	6MN173B922	00104B73B922	21G0B347FUIT80
Shungnak		n/a					

SERIAL NUMBERS

VILLAGE	Monitor	Otoscope Light Source	Otoscope Light Source	Otoscope Camera	Otoscope Probe
	Manufacturer's Serial #	Manufacturer's Serial #	UAA #	Serial #	Serial #
ANMC					
UAA					
KOTZEBUE		EN100414	195582	9745P560	MN95053
Ambler		EN100428	195654	9745P618	MN98975
Buckland			n/a		
Deering			n/a		
Kiana		EN100404	195652	9745P599	MN97617
Kivalina			n/a		
Kobuk			n/a		
Noatak		EN100457	195657	9746P640	MN97612
Noorvik		EN100432	195589	9745P612	MN97461
Selawik		EN100420	195590	9745P583	MN98974
Shungnak			n/a		

SERIAL NUMBERS

VILLAGE	Digital Camera	UPS (Battery Backup)	Cart	Printer
	Serial #	Serial #	Serial #	Serial #
ANMC				
UAA				
KOTZEBUE				
Ambler				
Buckland				
Deering				
Kiana				
Kivalina				
Kobuk				
Noatak				
Noorvik				
Selawik				
Shungnak				

SERIAL NUMBERS

VILLAGE	CPU	CPU	AGP SLOT Matrox Millenium II	PCI #1 FlashBus MV Pro	PCI #3 3COM 3C905 NIC	PCI #3 3COM 3C905 NIC	ISA #2 US Robotics 56K V.Everything Internal Modem
	Manufacturer's Serial #	UAA #	Serial #	Serial #	Serial #	EA #	Serial #
ANMC	9558392	195826	CCM49910	IT1032575	6MN173B93B	00104B73B93B	21QR27Q7FF6L
UAA	9558391	195825	CCL03254	IT1026321	6MN173B960	00104B73B960	21QR28D7727R
KOTZEBUE	9558387	195822	ABQ57878	IT1032500	6MN173B948	00104B73B948	21QR28D77280
Ambler	9558389	195821	CCL03599	IT20005007	6MN173B95B	00104B73B95B	21QR28D77281
Buckland		n/a					
Deering		n/a					
Kiana	9558385	195823	CCL03687	IT1032565	6MN173B93A	00104B73B93A	21QR28D7728I
Kivalina		n/a					
Kobuk		n/a					
Noatak	9558386	195820	CCL03920	IT1032576	6MN173B93C	00104B73B93C	21QR28D7727V
Noorvik	9558388	195827	CCL03900	IT1032535	6MN173B937	00104B73B937	21QR28D7728V
Selawik	9558390	195824	CCL03597	IT1032501	6MN173B922	00104B73B922	21G0B347FUIT80
Shungnak		n/a					

5.4

SERIAL NUMBERS

VILLAGE	Monitor	Otoscope Light Source	Otoscope Light Source	Otoscope Camera	Otoscope Probe
	Manufacturer's Serial #	Manufacturer's Serial #	UAA #	Serial #	Serial #
ANMC					
UAA					
KOTZEBUE		EN100414	195582	9745P560	MN95053
Ambler		EN100428	195654	9745P618	MN98975
Buckland			n/a		
Deering			n/a		
Kiana		EN100404	195652	9745P599	MN97617
Kivalina			n/a		
Kobuk			n/a		
Noatak		EN100457	195657	9746P640	MN97612
Noorvik		EN100432	195589	9745P612	MN97461
Selawik		EN100420	195590	9745P583	MN98974
Shungnak			n/a		

SERIAL NUMBERS

VILLAGE	Digital Camera	UPS (Battery Backup)	Cart	Printer
	Serial #	Serial #	Serial #	Serial #
ANMC				
UAA				
KOTZEBUE				
Ambler				
Buckland				
Deering				
Kiana				
Kivalina				
Kobuk				
Noatak				
Noorvik				
Selawik				
Shungnak				

TELEMEDICINE HARDWARE INSTALLATION

INSTRUCTIONS

- Please complete all pages of this form.
- Return the form to Eugene Smith, who will forward the form to ANHB.

(1) Village Name: _____

(2) Your name (installer): _____

(3) Today's date (of installation): _____

(4) Please indicate if the following boxes arrived at the village:

	Arrived
Cart - Box 1 of 6	☐
Cart - Box 2 of 6	☐
Cart - Box 3 of 6	☐
Cart - Box 4 of 6	☐
Cart - Box 5 of 6	☐
Cart - Box 6 of 6	☐
Otoscope	☐
CPU	☐
Monitor	☐
Speakers	☐
Battery Backup	☐
Cart Hardware	☐
Printer	☐
Digital Camera	☐

TELEMEDICINE HARDWARE INSTALLATION

(5) Please complete the following table after installing the equipment.

- UAA Serial # only required at Maniilaq, Ambler, Kiana, Noatak, Noorvik, and Selawik.

	Make / Model	Manufacturer Serial #	UAA Serial #
Workstation CPU	Gateway _____	_____	_____
Workstation Monitor	Gateway _____	_____	
Otoscope Processor / Light Source	_____	_____	_____
Otoscope Camera	_____	_____	
Otoscope Probe	_____	_____	
Digital Camera	Sony Mavica FD7	_____	
Modem	USR _____	_____	
Battery Backup	APC Backups Pro 650	_____	
Cart	Anthro _____	_____	
Printer	HP _____	_____	

(6) Please complete the following table after testing the equipment.

- Logon as "ATTPAdmin" with password "ATTPpassword".
- Any BIOS changes require using the password "ATTP"

	OK	Problems / Comments
Windows NT bootup	☐	_____
HP Print test page	☐	_____
3COM NIC diagnostics	☐	_____
CD Player and Speakers	☐	_____
3.5" Floppy Disk Drive	☐	_____
Sound Recorder	☐	_____
Dial up access to UAA (Please note timing results on back)	☐	_____
FlashBus and Otoscope	☐	_____
PowerChute Plus and UPS	☐	_____

(7) Please enter any additional comments or problems encountered on back of this form.

6.2

CDROM Contents

PROJECT OVERVIEW

- NLM Project
- Introductory video
- Maps
- History
- Legal and regulatory (Health Aide)
- Legal and regulatory (Physician)
- Glossary
- Copies of survey forms

THE ATTP WORKSTATION

- Otoscope operation and troubleshooting
- Otoscope pictures
- Advanced otoscope troubleshooting (Tech Support)
- Computer hardware operation and troubleshooting
- Computer pictures
- Advanced computer troubleshooting (Tech Support)
- Telemedicine software how-to
- Telemedicine software screens
- Advanced telemedicine software (Tech Support)
- Advanced telemedicine software (Physician)
- Other computer software, ie NT OS, VirusScan, CD-ROMS
- ATS/First Class, ie e-mail, conferencing, chats, etc.

PROJECT PROTOCOL

- CHAM protocol
- Telemedicine forms and procedures (Health Aide)
- Telemedicine forms and procedures (Physician)
- Wax removal
- Wax museum
- Handling tough cases, ie children, infants, elders, etc.

PROJECT HELP

- List of resources
- Troubleshooting diagrams/forms
- 800 numbers and names
- E-mail support

ALASKA TELEMEDICINE TESTBED PROJECT

Quarterly Report – Fourth Quarter FY '99
July 1, 1999 – September 30, 1999

Submitted by: Denise Statz, Project Manager
ALASKA NATIVE HEALTH BOARD

Long delays in the finalization of software and the postponement in deployment, installation and clinical staff training for this project resulted in continuation in the contractual relationship between the University of Alaska (UAA) and the Alaska Native Health Board (ANHB.).

STAFFING: Sonia Vent position was extended through July, enabling her to complete village staff training in the Norton Sound region.

Linda Curda, a MPH nurse mid-wife provided training for the Savoonga staff. Linda serves as the CHA Program Liaison for the University of Alaska, Bethel Campus. During her twenty-year history with the program, she has gained a reputation as a dedicated advocate for educational systems and tools that meet the unique needs of rural students. She has been instrumental in the development of computer based distance learning, CD-ROMs on "Body Systems and Patient Care" (enclosed) and breast health, as well as developing numerous curriculum designed to students' needs as they seek entrance to nursing, Physician Assistant and pre-medicine programs. Linda's enthusiasm for this project and her understanding of it's potential impact on rural health care made her an excellent representative of the program, as has been clearly indicated by the sheer number of telemedicine referrals from Savoonga.

Heidi Hammond, a University staff member who has completed data entry, assisted in the development of training tools, and initiated much of the day-to-day contact with clinic staff throughout the project, completed staff training in Kotlik and Marshall (Yukon Kuskokwim region.) Heidi, originally from the Bristol Bay area, regards the CHA program highly and is detailed and considerate in her interaction with it's members. Staff who received initial training from Heidi were complementary regarding her thoroughness in verifying their skill and confidence in completing cases, as well as her follow-up on problems and questions they encountered.

The program continued to benefit from the assistance of the Alaska Clinical Engineering Services (ACES) staff, a branch of the Alaska Native Medical Center, under the direction of Denver Lodge and Herb Sivitz. Various members of this group of biomedical engineers and technicians have completed installation and testing of equipment in the regional centers and five villages in each of the Norton Sound, Bristol Bay and Yukon Kuskokwim regions. Staff wages have been provided as in-kind contribution to the project.

TRAVEL REPORTS: SEE ATTACHED

A tremendous amount of travel was completed during this quarter. One or more site visits were made to each of the four rural partners. The focus of these visits was staff training, review or retraining where requested, and quality assurance review.

TRAINING MATERIALS: Enclosed are CD-ROMs that contain short videos on ear wax removal and patient encounters, as well as the digitized version of the resource manual and a power point presentation on tympanic membrane descriptors that link terminology with examples of common abnormalities.

While all of this material has been useful, it is still short of "final draft" and could use re-working to improve clinical value.

DEPLOYMENT AND TRAINING:

Norton Sound Health Corporation: Sonia Vent completed Elim staff training July 21 – 23rd. Simultaneous with that training a site visit was made to Nome. That scheduled enabled us to provide some support for medical staff, complete a quality assurance review, and provide prompt evaluation and feed-back to Elim regarding image quality and thoroughness of documentation.

Staffing in Gambell prohibited timely completion of staff training. Illness and absence left that facility without permanent staff through much of the summer and it was suggested training be delayed until adequate staffing was available. The week of September 14, Community Health Practitioner Bonnie Armstrong and Community Health Representative Rena Booshu completed training in Nome.

Yukon Kuskokwim Regional Health Corporation: Staff in the five villages of the YKHC region and the Bethel hospital completed training during August and September.

Revisits to the Bethel hospital enabled us to complete training with additional staff. However, several areas necessary for a fully functional and clinically useful system have not been met. Specifically, additional staff training is required for which adequate time is allocated to practice initiating and responding to cases, the patient database at the Bethel hospital requires modification, and a quality assurance protocol should be developed to evaluate the quality of images, thoroughness of documentation and timeliness of response.

See attached travel reports for comments regarding that schedule, difficulties encountered and suggestions.

Bristol Bay:

Revisits to the Dillingham (Kanakanak) hospital have provided an opportunity for providers to review and expand their skills and there is evidence that certain practitioners are capturing images and archiving them for later comparison, or transmitting them for consults. Outpatient nursing staff include preparation of the telemedicine equipment (turn on, log-on, white balance, focus) in their morning routine, which encourages more spontaneous use of the equipment by medical staff.

OTHER ACTIVITES:

Nearly fifty CHAs from across the YKHC region met for a week of continuing medical education in St. Mary's, on the Yukon River, in August. ANHB and University NLM project staff were invited to attend that meeting to present and demonstrate the equipment. The CHAs stated that they could "see a lot of use for this kind of equipment." Most of those in attendance had the chance to capture images of their own eardrums, as well as those of a co-worker or friend.

In early September a "CHA TRAINERS CONVOCATION" was held in Anchorage and staff was asked to demonstrate the equipment at that event. Nurse Practitioners, CHPs, Physician Assistants, nurses and doctors in attendance were enthusiastic in their comments and eagerly experimented with the otoscope and software.

The week of September 13, NLM staff was asked to speak at a Norton Sound CHA continuing medical education conference in Nome. A half-day was spent demonstrating the equipment and giving the CHAs the opportunity to handle the otoscope, digital camera and software. This group of senior CHAs (many with more than 25 years of experience) quickly proved how easy it is to use the system. Describing themselves as "non-users" or having limited computer experience, they were capturing images and completing cases within the first hour. They, like other groups, discussed the many possible uses, and the system's great capacity to improve clinical communication.

TRAVEL REPORT:
Dillingham 6/30 - 7/3
Denise Statz ATTP Project Manager

GOALS: Quality assurance review, introduce Dr. Barbara Riley to the system, provide support, training, or re-training as requested.

Travel, originally scheduled for Tuesday June 29, was delayed due to non-receipt of documentation for continuation of the UAA – ANHB contract. This documentation, first requested at an April 26th meeting, had an original deadline of May 30. Extensions had twice been negotiated, first to June 18th, then June 25, to accommodate Dr. Pearce's schedule. Contact with Dr. Pearce resulted in his reassurance that the paperwork was being "walked through" and that the University intention was to fund the continuation. On the authority of Leo Morgan, I was able to revise my travel plans.

Notified by CHAs in the villages Goodnews Bay and Perryville that their systems were not working. Contacted the local IS department who stated that they had not been aware of the specific problem with the telemedicine, but were struggling with agency wide problems related to server changes they had recently completed.

I notified the administrative assistant for the medical staff of my delay, and contacted Dr. Riley to arrange time around her busy clinic and call schedule.

Wednesday, June 30: Travel in to the Dillingham area was exceptionally heavy. Between the booming commercial and sports salmon fishing industries, and growing numbers of eco-tourists traveling for bird watching or to make connections to Katmai National Park or Round Island walrus sanctuary, no confirmed seats were available on either Peninsula Air or Alaska until the 2nd of July. Patience was ultimately rewarded, following a nearly 9 hour wait I was able to get on as a standby passenger on a 5:10 p.m flight, arriving in Dillingham at 6:30 p.m.

I went directly to the hospital and was able to access the system to complete a quality assurance review on 43 cases. Findings for this initial period of use were consistent with what we had seen in the Maniilaq region:

A few smart forms were incomplete
Cases occasionally did not include images
Images were not consistently renamed
In some cases the CHA had not commented on TM mobility

Where images were not of diagnostic quality the problems included impacted wax, patient or otoscope movement, smudging of the otoscope tip, or failure to insert the otoscope adequately. Koliganek cases had not been opened, and only one case had been received from Perryville. No one village or provider stood out for their frequency or consistency of problems. However, Port Heiden seemed to be the one site that was sending the most thoroughly completed smart forms and the sharpest (clearest) images. Looking at the referral messages, it was clear that Dr. Mc Grath (the referral physician for that village) had set a high threshold for quality and was providing very specific instruction regarding exactly what he was looking for, and how to achieve the best images. I completed my work at 11:30 pm, and checked in to the bed and breakfast.

THURSDAY, July 1: Knowing the two day delay could adversely impact physician availability, I arrived at the hospital at 6:45 a.m., notified the staff at the inpatient desk of my availability. I went to the out patient department to turn on the system, then made my way to the kitchen where

I was able to greet the staff and remind them I would be available for the next two days to work with them.

When the out-patient staff arrived I retrieved the digital camera, charged the battery and waited in the clinic for a chance to meet with the medical staff.

Dr. Riley, who was coming off call, came to the clinic at 8:45 am and within a few minutes she had Drs. Powers and Gerrish, and three of the out-patient nurses in the room for a refresher. Many practical questions were asked, and problems they had encountered were resolved.

That first group split up at about 11:30, and the rest of the day was spent with individual nurses and medical staff, primarily working through problems and questions they had encountered as they used the equipment. With each provider I took time to review printing of cases for inclusion in patient charts, and the reproducible "glitches" encountered in responding to cases.

Contact with the IS department indicated that no resolution to the server problem had been achieved, but they were working on the problem and step by step various offices within the agency were being reconnected.

I ended the day at 6:30, and spent the evening with a lifetime friend cutting fish for canning.

FRIDAY, July 2: Arrived at the clinic at 7:15 am. After talking to the manager of the IS department, who reported that the connectivity problem had not been resolved, I contacted each of the participating villages to notify them of this situation, and asked them to await my call early Tuesday to update them.

The bulk of my day was spent with individual staff initiating cases and responding to those cases, practicing with the digital camera and inserting images from the camera to cases.

I spent nearly three hours with Dr. Powers looking at images, reviewing quality assurance parameters, and introducing general e-mail use.

No seats were available on the 7:10 flight.

SATURDAY, July 3: Left Dillingham on the 9:15 flight, arriving Anchorage at approximately 10:45, and at my home at 1:20 pm.

TRAVEL REPORT:
Dillingham 7/6 – 7/9/99
Denise Statz ATTP Project Manager

This trip began early Tuesday morning, July 6th. Heavy fog over the Dillingham airport demanded two tries to get on the runway, safely landing at 10:05 am.

Immediately on arrival I took a taxi to the hospital along with Dr. Kokesh who had been on the same flight. We took a few minutes to move the cart in to the specialty clinic office, set it up and provide him with a very brief orientation so he could use the system to capture images and use the system to provide patient education.

My main goals for this visit, beyond introducing the system to the ENT specialty clinic at Dr. Kokesh's request, included providing CHA support as the telemedicine system was brought back on line, and helping to engineer increased use of the system in the outpatient clinic setting.

Contact with the IS department verified that the system was still not up and running in the villages, but that they had broadened the local area in which the system was fully functional. I contacted each village to ask that they bear with us pending resolution of the problem.

The remainder of that day, and all of Wednesday and Thursday were a flurry of activity – working one on one with Dr(s) Elliot, Riley, Powers, Gerrish, and to a more limited extent with PA-C James Wojchieski. Numerous previously undescribed "glitches" came up: repeated loss of the mouse arrow that resulted in slowing of the response process (JW), the disappearance of previously viewed images from cases in the in-box (BR), lock-up of the keyboard. We focused on skills practice: initiating cases, responding to cases, insertion of digital images, printing of cases etc. It was very clear that the staff were experienced enough to have developed a sense of what they lacked information on, and they were able to consistently work around the glitches.

The interest of the physicians, the specificity of questions based on their experience with the system, and their discussion of ideas and plans for expanded use of the system was very encouraging.

Each day I checked back with the IS department. When no resolution has been uncovered by Thursday morning, I made contact with Stewart Ferguson who is currently 30/70% NLM/AFHCAN. Along with Darren Coolidge and Tom Bowen (AHFCAN) he was able to determine fairly quickly the nature of the problem (IP address duplication) and agreed to arrange for Darren to come to Dillingham to provide support in tracking the problem the following day.

Darren arrived at 2:20 pm on Friday, and by 5:30 three villages had logged on and shipped images. The CHAs were delighted, as were their referral physicians.

I returned to Anchorage that evening, leaving Anchorage at 7:10 and arriving at 9:15 pm.

TRAVEL REPORT:
St. Mary's 8/9 - 8/13
Bethel 8/16 – 8/20
Hooper Bay/Chevak 8/24 – 8/26
Denise Statz ATTP Project Manager

ST.MARY'S

8/9 Traveled via Peninsula Airways to St. Mary's for participation in the 10th annual CHA/P Conference, arriving in the early afternoon. Aboard my flight were representatives from the IHS CHAP/Rural Affairs office, and the University of Washington Medex Northwest PA training program. We were met by the caretaker of the St Mary's mission Eric Weingarth, who provided transportion to the conference center dorms.

That first evening Stewart Ferguson and I got some help from Eric who contacted the on-call CHA for access to the clinic, so we could pick up the telemedicine cart for transport to the conference center. We were able to arrange the training area hook up and test the equipment that evening.

8/10 Met and worked with 2 groups of approximately 10 – 12 CHAs to introduce and demonstrate the telemedicine equipment. The YKHC CHAP training staff had requested that we work outside the program software to capture images to a disk and then have the CHAs e-mail those images from laptops they had set up in a training area adjacent to our area. While this seemed redundant and did not demonstrate the NLM software to its best advantage, I complied with the request – but made sure ample time was spent actually demonstrating project hardware and software, as well. The CHAs all had the opportunity to use the otoscope and most commented favorably regarding the possible benefits of the system.

8/11 Telemedicine training was completed for four of five St. Mary's CHA/P staff. We worked in the morning with two staff members and in the afternoon with the other two, thus preventing any interruption of clinic operations. Despite the fact that the St. Mary's staff had demonstrated abysmally poor participation in the pre-intervention survey process they were excellent, interested, capable participants in the hands-on training.

That evening I was asked to meet with the administrative staff of the YKHC CHA/P program to discuss the training schedule for the remaining four YKHC villages. I was very disappointed when non-specific concerns were voiced regarding a contract employees credentials or capacity to adequately train the Chevak staff, as scheduled, the following week. To avoid any conflict I agreed to do that training myself. However, I want the record to show that the individual had done an exemplary job providing training previously. The decision to submit to the request for alternative staffing was mine and mine alone, and was done to expedite the process and avoid conflict.

8/12 The morning was spent reviewing skills with the St. Mary's Staff.

It is important to note that the limited time spent with this group, and in each of the subsequent YKHC villages, was done at the request of and on the authority of, YKHC training director Kurt Madison, who opted not to have the CHAs receive University credit, and chose not to have us review ear disease or diagnostic terminology/indicators.

The afternoon was spent with 2 groups of 8 –10 CHAs, again demonstrating the equipment and helping them to capture images of their own tympanic membranes, for transmission by e-mail.

Returned to Anchorage mid-afternoon, arriving at 4:30 pm.

BETHEL

8/16 Traveled via Reeves Aleutian Airways, leaving Anchorage at 7:30 am. My traveling companion was Dr. Bill Miner, ANMC pediatrician.

The first day was spent retrieving equipment, finding a workspace, working with the IS program to add memory (which had been left three weeks earlier) to the hard drive, scheduling staff orientation, and struggling to get the system reconnected to the network – apparently the jack it was connected to was dead – despite the fact that during Stewart's visit they had effectively tested the system

8/17 A rather sparse schedule of two hour orientation and return demonstrations were held, with a variety of people. No set-aside time had been scheduled for physician orientation, so we did our best to make ourselves available at their convenience.

8/18 On Wednesday the weather closed in and the first flight to Hooper Bay left at about 2:00 pm – delayed from the 10:30 departure. This forced me to reschedule my trip, based on the fact that it would only permit me a ½ day visit in Hooper Bay, because I was due back in Bethel on Friday to train additional staff. I spent most of the afternoon arranging for time with the remaining Group 1 medical staff, and scheduling an additional trip in mid-September to work those who were not able to complete orientation during this visit as well as with the pediatricians.

8/19 – 8/20 Again, sparse series of orientations. This was, overall, a very disappointing visit. I felt that our visit had not been well planned – that the time necessary for us to meet and work with staff had not been scheuduled, and that incorporation of this telemedicine system has not been seriously considered or worked out within the YKHC (location, quality assurance, how to arrange adequate time during medical traffic etc).

The only beneficial thing to come of this week was the fact that two of the medical staff – having received cases from Kotlik and St. Mary's – realized the necessity of training to respond to the cases, and thus sought time with us.

HOOPER BAY/CHEVAK

8/24 –25 The very early 6:00 am departure of the Alaska Airlines flight to Bethel necessitated a 3:00 am departure from my home, allowing time to pick up materials from the office and check in on time.

Arrived Hooper Bay at 10:15. The CHAs, who we have been clearly told NOT to make direct contact with, had not been warned of my visit. They were however very excited about the telemedicine, and rearranged schedules and alternated patients to allow time for training. We worked in pairs the remainder of the morning and during the afternoon (two hour sessions) then met from 6 pm to 10 pm for them to individually demonstrate skills.

Because the CHAs are concerned about the numerous dermal problems the encounter and the inherent difficulty associated with referring (terminology, descriptors) they asked how to use the otoscope camera to capture these images. Although it is not a perfect solution, I did provide them

with some training in this regard. Additionally Hooper Bay was a very uplifting environment because the CHA promptly put the system to work, examining ears, providing patient education, scheduling revisits and archiving their exam findings for later comparison.

The next morning, my confirmed seat on the Hooper Bay - Chevak flight was cancelled, because the plane had been rerouted. That actually worked to everyone's advantage, because I was able to work with each of the CHPs to give them at least one additional opportunity to complete and transmit a case.

8/25 – 26 CHEVAK: Several staff members were absent due to training or personal needs. I worked in pairs with the CHA staff, the first afternoon and evening two of the CHPs stayed from 2:30 pm until 7 pm and the next morning I was able to work with another team. Then, as patient's arrived the CHAs put the system to work. It was gratifying to have Dr. Provencio, the referral physician respond to cases and share the CHAs enthusiasm.

SUMMARY:

8/9 ST MARY'S – Returned home one day early.
8/16 BETHEL - Hooper Bay visit cancelled due to weather. The time was spent in Bethel, instead.

The CHAs in Hooper Bay, Kotlik, Chevak, and St.Mary's all report they are not using the digital cameras purchased for them. I have asked Dr. Pearce to consider buying the Sony cameras for these villages, which could ABSOLUTELY benefit from their availability and the simple transmission tie-in to our system.

The limited 1 ½ day schedule is inadequate for adequate training. If funds become available, or the Sony cameras are purchased I strongly urge that an additional visit be made in each of the YKHC villages, and at the referral center.

The CHAs were a complete delight, they are strong, capable, caring, and good. They universally seemed pleased with the telemedicine system and shared their ideas regarding the potential benefit of this system.

TRAVEL REPORT:
Bethel 9/8 – 9/10
Denise Statz ATTP Project Manager

PRELIMINARY REPORT ONLY:

9/8/99 – My traveling companion for this trip was Heidi Hammond. The 6 am Alaska Airlines flight was delayed due to weather, finally departing at 2:30 p.m. This very early departure has twice proven to be both financially and physically an absolutely exhaustive and miserable alternative, and would not ever again be acceptable to me. The schedule demands that I leave home by 3: 30 am which requires me to arrange (and pay for) over night childcare. Additionally, any hope of sleep is out of the question, and as a result I have found myself thoroughly exhausted by the late afternoon of the day of travel.

Arriving in Bethel in the late afternoon, we were able to check in with the nursing staff to alert them to our availability the following day, and check the equipment, which by report had "not been working since you were here."

It turned out that the equipment was plugged in to a dead jack (again), a problem which was quickly rectified.

We checked in at Bentley's Porter House at about 6 pm.

9/9/99

I arrived at the hospital at 7:30 am. The first order of the day was to investigate the use of the system. A check of the In Box revealed:

Hooper Bay Three cases, all read. No cases received since my trip the two weeks prior. Contact with the CHAs in Hooper Bay indicated that they had neglected to select the "Send and Receive" function, so cases were accumulating in the Out box. The process was reviewed with them and 6 cases were received.

THE PA WHO NORMALLY REVIEWS THEIR CASES WAS OUT OF TOWN, SO I CONTACTED THE "WARD DOCTOR" WHO WOULD NORMALLY TAKE THEIR RMT. UNFORTUNATELY, ON FRIDAY THE 10TH, THE CASES HAD STILL NOT BEEN OPENED.

CHEVAK Three recent cases, two had been read. One case rec'd 9/9, unread. I contacted the CHA there (Suzie Friday Tall) who reported they had not been using the system much, due to absences and holidays, but that they had been using it locally to instruct patients.

KOTLIK No cases. Contact with the CHA indicated that they were having difficulty "connecting." The process of sending and sending and receiving was reviewed and a number of cases were received over the next several hours.

ST MARY'S Three cases, none read.

Over the next two days I was able to work with Dr. Finkelstein, who responded to the cases thoroughly, advising the CHAs re: quality, documentation etc.

The second goal of the day was to find a space for the equipment to reside. That problem was resolved when Martha Flores, PA-C suggested that it be located in room 1 of the group 1 hallway. This may be the best solution to the problem, given that the physicians will have access to the equipment and as they develop skill with it they will be better able to make recommendations to the CHAs on how to improve the quality of their images.

The rest of the day was spent trying to schedule staff for orientation. I made appointment with the staff from the pediatrics group, but was unable to schedule any time at all with the family practice staff.

9/10

I arrived at the hospital at 8 am, having been told that I would have the opportunity to meet with pediatrics staff throughout the day. However, other that one nursing staff member who showed great aptitude for the system – and spent well over two hours learning it, and practicing with it, little other training took place.

Specifically, I did have the chance to show the system to Dr. Garza, and NP Vince C.

I believe that with (nurse) Robynn's assistance, the system could quite effectively be put to use in that group.

SUGGESTIONS:

- **Clean up and install the local data base so that, like every other site, a patient data base is available**
- **Arrange it so that each of the physicians can receive and review cases at their desk top. The current system is too cumbersome and discourages use**
- **Purchase digital cameras for each of the participating clinics**
- **Arrange travel for introduction of the digital cameras, and review of skills associated with the use of the system in EACH of the participating villages, insuring that itinerant coverage is available to insure full staff participation**
- **Arrange for orientation of EACH of medical staff members: 4 – 5 from pediatrics, Dr(s) Finkelstein, Schlar, Provencio, Johnson, Martinez, and the PA-s Martha Flores and Stan Whittaker**
- **Arrange for re-introduction of the Group 1 and Pediatrics nursing staff**

The total time for training/retraining of 5 village staffs and the medical staff would be approximately 5 days, with two trainers. The time could be scheduled for the last week of the month, if this was so desired.

TRAVEL REPORT:
Bethel 9/14 – 9/18
Denise Statz ATTP Project Manager

Tuesday 9/14 –Traveled via Peninsula Air to Nome, via Unalakleet. The Bering Air flight had been cancelled, despite my call the night before to confirm the reservation. With the prospect of a long layover and delays in previously scheduled appointments looming, I was forced to fly Haglund Air to Nome, arriving at 1:30 pm.

I went directly to the village health services office where I met with Phyllis Farrell (Coordinator Instructor, and Shirley Thronton (Administrative Assistant) to discuss the possibility of arranging for Gambell staff to attend training in Nome later in the week. It was determined that Rena Booshu, a former CHP currently working as a clinic travel clerk would come in on Wednesday the 15th for training that afternoon and the next morning.

That completed, I went to the hospital to work out a schedule with new staff and those who required some additional training. Many of the medical staff were scheduled to be out of the facility during the week, as they were completing school screenings in the villages. Despite that however, I was able to schedule time with Dr(s) Peterson, Swenson, Scofield and O'Neill. New physicians Lanier and McClung were not available.

My next step was to move the cart to a convenient location in the administration area, and make contact with Mike Brooks from the IS department.

I left the facility at 5:30 p.m.

Wednesday 9/15

The entire morning was spent with Dr(s) Swenson and Scofield . They practiced all steps involved with initiating a referral, then responding to some cases received from the villages. This was particularly useful because it gave them the opportunity to make comments regarding the quality of images – and use what they knew about the cameras to advise the CHPs about how to improve the images.

From 1 to 3:30 that afternoon I met with eight senior CHPs, in Nome as part of a continuing medical education course, to introduce the equipment. This was an opportunity for the to handle the otoscope and digital camera, see examples of cases received within the region, and pose questions about the study. They were very enthusiastic about the equipment and the prospect of telemedicine availability in their own villages. Only one of the participating villages (St. Michael's) was represented and the health aide from that village reported that she had not used the equipment and did not feel comfortable with it. She had a chance to step forward and complete a case, which she did with little difficulty. I arranged to call during the next week to provide her and her co-workers with an audio-conference review of the system.

The rest of the afternoon and early evening was spent with Rena Booshu, from Gambell. She quickly picked up the nuances of the equipment and within two hours was completing cases independently, without difficulty. Because I was scheduled to do a lecture the following morning, she agreed to meet me at 11 am to continue training, and was encouraged to use the equipment to practice as much as she wished in the meantime.

9/16/99 The morning was spent at the Health Aide Training Center. I had been asked to present a continuing medical education lecture on the topic of "Documentation of Patient Care." This was a wonderful opportunity to work with eight lovely senior CHPs from the Norton Sound region. Several of this group had in excess of thirty years of experience, and now work with their daughters who carry the torch of their dedication and care. All of the participants had been members of the staff during my brief employment as CHAP director for Norton Sound. This represented the first opportunity we have had to come together since I had made the difficult decision not to return to Nome following the birth of my son two years ago. It was an emotional and healing gathering – with many words of encouragement and support between us. Of the many opportunities this project has provided me, I believe that this was the most personally gratifying.

The topic of documentation was approached from a traditional (low tech) perspective. We discussed the art of recording and reporting on behalf of a patient, the importance of thoroughness and detail, the legal and ethical responsibility that are shouldered in this relationship. But the previous days introduction to telemedicine had left the CHPs with many new concepts about how that equipment could be incorporated in their patient/provider interface and improve the documentation of patient problems and the care provided. Clearly, the CHPs understand that in the telemedicine environment, a thousand words are worth a picture.

The early afternoon was spent with Rena Booshu and Bonnie Armstrong, Gambell CHP. Bonnie's arrival was a welcome surprise. Rena presented the equipment, showing Bonnie exactly how to complete a case. It was a great "See One, Do One, Teach One" session, and I believe it was an excellent opportunity for Rena to test her training skills. Rena had to leave at 2:15, and Bonnie and I continued to work together the rest of the afternoon.

Friday, 9/17

The morning was spent reviewing the use of the equipment and software with Bonnie. Following her departure at 1:30 pm, to return home, I spent the rest of the afternoon completing a quality assurance review with Dr. Karen O'Neill.

ELIM No use of the system since late July. The quality of the images up to that time were excellent. It was suggested that the clinic had been short-staffed during late August and early September, and that during the summer months, like other sites, Elim may not have been seeing as many patients.

9/23 – Phone contact with Evelyn and Jeanne confirm the short staffing and lack of telemedicine appropriate patients. They agreed to turn on the equipment today to check for Dr. Swenson's comments, and get back into the swing of using the equipment.

SAVOONGA Frequent and varied use. All staff members appear to be skilled in use of the otoscope, digital camera and software.

ST. MICHAEL No use since early August. Contact will be made as per my discussion with CHA Virginia Shipton, to provide them support and retraining as required. The presence of a PA in Stebbins may also discourage use of the equipment. Recognizing that, I dropped the PA a note asking him to provide the CHAs with his e-mail address so they can that they can send him images – even if he can't translate the smart form.

SHISHMAREF No use since initial training. This is undoubtedly due to the availability of an on site PA for referral.

9/18 Departed Nome at 9:30 am, arriving home via Unalakleet, at 2:30 pm.

TRAVEL REPORT
Heidi Hammond

St. Mary's	8/10 - 8/12
Bethel	8/17
Kotlik	8/18 - 8/19

St. Mary's

8/10 I was scheduled to leave Anchorage for St. Mary's on Peninsula Airways the previous day (8/9), however due to weather, I was delayed in returning to Anchorage from another trip. I arrived in St. Mary's early Tuesday afternoon (8/10) and spent the rest of the day meeting with health aides who were training to use the telemedicine equipment.

8/11 Participated in demonstrating telemedicine equipment to health aides. We worked with half of St. Mary's staff in the morning and the other half in the afternoon.

I met with Denise and YKHC CHA/P staff Wednesday evening to discuss the training schedule for the remaining YK clinics.

8/12 Thursday morning and early afternoon was spent reviewing telemedicine equipment use with St. Mary's health aides.

I returned to Anchorage late Thursday afternoon, arriving at 4:30 PM.

Bethel/Kotlik

8/17 Arrived in Bethel early Tuesday evening and was met at the airport by Denise and Linda Kurda.

8/18 I was scheduled to leave Bethel for Kotlik Wednesday morning. Due to heavy fog, the flight was delayed until mid afternoon. Upon arrival at the Kotlik clinic, I hooked up the equipment to a telephone line and verified that everything was in working order. Not wanting to waste the rest of the day and evening since my arrival had been delayed, I was able to convince the health aides to return to the clinic at 7:00 PM for training. They agreed without hesitation. Meanwhile, in their absence I was able to demonstrate the equipment to YKHC staff that accompanied me on the trip.

8/19 Training continued with Kotlik health aides. I was scheduled to leave early in the afternoon, but I was able to change my reservations to the last flight out of Kotlik late that afternoon.

Arrived back in Anchorage at 9:30 PM.

TRAVEL REPORT: HEIDI HAMMOND

Bethel	September 8
Marshall	September 9-10
St. Mary's	Cancelled
Bethel	September 10

September 8

We (Denise Statz and I) were scheduled to leave Anchorage for Bethel on a 6AM flight that was eventually cancelled. We were rebooked on the 1:55 PM that arrived in Bethel at approximately 3:30. I had contacted the Marshall clinic to let them know I had been delayed due to weather since I was suppose to have arrived in Marshall at 9 AM. To my dismay the health aide I had contacted several days before hand forgot to tell anyone else that I was coming for training. They had patients scheduled for the entire day and Thursday morning. Apparently the administration in Bethel also neglected to contact Marshall about the schedule that they had okayed several weeks earlier when we met with them in St. Mary's.

Once in Bethel, we got in touch with St. Mary's clinic to see if I could possibly go there that afternoon and work with them that evening and the next morning and then go to Marshall. Due to flight schedules and realizing that they were having visits with doctors and pharmacists, St. Mary's had to cancel my entire visit. I stayed with Denise in Bethel that night.

September 9

I spent the morning at the hospital in Bethel with Denise checking on cases that had been send in from clinics and got in touch with those who had not apparently been using the system. It turned out that most were having trouble sending the completed cases in. Some of the cases sent in had not received a response from medical staff.

I left for Marshall late that morning and spent the rest of the day working with four health aides. They were quick to catch on, took very good images from the start, and showed a lot of enthusiasm. I was hoping to get some or all of the health aides to returned that evening for additional training since we weren't able to work that morning, but due to babysitting problems and other reasons no one was able to come back until Friday morning.

We did run into some trouble sending cases to Bethel. The phone number had to be dialed manually each time, which was awkward, time consuming and not the way the system should have been set up. I left messages for Stewart concerning the problem. He was able to get back in touch with me that evening and walked me through the steps to rectify the problem.

September 10

We resumed training Friday morning until noon when everyone left for lunch. Patients were scheduled that afternoon and getting ready for hunting/camping trips took precedence over additional training. They all assured me though, that they felt comfortable using the equipment.

I returned to Bethel Friday afternoon and waited at the hospital with Denise for our 7PM departure back to Anchorage. Arrived in Anchorage shortly after 8PM.

To: Denise Statz, Telemedicine Trip Report
Fr: Linda Curda, Ass't Professor, UAF LKC
Date: 7/14/99
Re: Telemedicine Teaching – Savoonga Clinic June 16-18, 1999

Schedule Overview:

June 13th - Traveled to Anchorage

14th - 8:30 to 5:15 pm: Training with Denise Statz at ANHB use of equipment and materials

15th - Travel to Nome; visit to Unalakleet clinic enroute Evening dinner with Dr. Karen O'Neill and Ann Peonka

16th - 18th Telemedicine training at the Savoonga Clinic Using Telemedicine Project Reference Notebook and objectives provide training to four CHPs.

19th – Returned to Anchorage

Students:

Carolyn Kava, CHP
Wanda Okoomealingok, CHP
Elsie "Pepsi" Pelewok, CHP
Mary Ann Wongitillin, CHP Float

Savoonga Trip (in more detail):

June 16th – Left Nome at 9 am; arrived in village at 10 am-directly to clinic; "old clinic" with two small exam rooms and a waiting area (which is also the clerks office, charts, weighing equipment, coffee and supply storage area). Met the four CHPs and two Clinic Travel clerks; clinic busy with patients. Reviewed clinic schedule with Lead CHP Carolyn Kava, blocked training time.

Pepsi P. was seeing a patient for follow-up (1 month) with severe facial trauma (4 wheeler accident); using the digital camera we were able to send pictures of the patient to Nome.

Afternoon spent with all 4 CHPs:

1) Introductions and overview of training.
2) Demonstrating the equipment going through the Telemedicine Workstation Notebook. Each CHP practiced using the otoscope in an ear.
3) Discussed telemedicine project isssues, concerns and expectations.

June 17th – 9 am – noon. Met with all four CHPs:

1) Reviewed Ear examination and clinical descriptors; students weak in an organized and complete ear exam (all the characteristics and descriptors).

2) Used the Body Systems and Patient Care CD-ROM to review anatomy and physiology (* key section on CD: where you can visualize the TM with verbal labels and then see behind the TM). The ability to see the middle ear, bones and location of facial nerve greatly helped the CHPs to understand ear functioning and disease.
3) Also viewed the Project CD presentation of Ear exam and descriptors.
4) One student went through all the steps for a "new case". Sent pictures to Nome; reviewed "cases" sent from Denise at Nome.

1-5pm Worked with individual CHPs using the equipment with patients.

Also two short visits:

Jerry Wongittilin Sr., Mayor
Fritz Waghiyi, IRA Council President

Discussed Telemedicine Project (positive opportunity that Savoonga was chosen as a site) and CHPs training. Stated the excellent job that the CHPs are doing in providing health care and the role that this project will play in improving communication with the Nome doctors. Also asked about status of the new clinic (currently condemned due to foundation problems) and getting another VPSO for the village. These 2 items were in support of the CHP issues.

Evening: Created a grid "Describing the Tympanic Membrane" with the four characteristics, normal and abnormal findings; includes other abnormal findings for description. Copies given to each CHP and for the 2 exam rooms (attached with this report).

June 18th – 9 am

Met with all 4 CHPs. Viewed videotape on ear exam positioning and holding patients to immobilize and removal of ear wax. Comment: "Helpful review – especially holding child with towel, new technique for me."
Removed all old Telemedicine Project consent forms, replaced and reviewed new forms.

Worked individually with each CHP: Reviewed each step from turning on to sending a "new case" to shut down. CHPs doing an excellent job at capturing a complete TM with 80-90% viewer screen. Each student was required to go through the Reference Notebook – reviewed sections on equipment maintenance, troubleshooting. Digital camera reviewed with Pepsi, Wanda and Mary Ann who is a float CHP (they will teach Carolyn).

A Telemedicine Skills List was completed with each CHP (see attached).

Carolyn got swamped with patients (a medivac) so we scheduled a follow-up phone call for 6/23 at 1:30 pm. During this phone call we went through the entire Notebook, quizzing on key items. She was well prepared; states she needs more practice to capture the image without shaking - yes, but she will master it as she has all the other skills. Since leaving the village 2 of the CHPs had used the equipment with patients successfully.

Each student received a copy of their University of Alaska transcript with an Associate of Applied Science Degree profile (see attached – feel free to share with NSHC). NOTE: Wanda O. is 3 credits (200 level) shy of her degree; students also given the Fall'99 audioconference schedule of courses.

Recommendations: (most of these we have already talked about, but are listed here for completeness of report).

1) Add a section to the Telemedicine Reference Notebook on:
   - printing out a case
   - how to label a picture, if NOT labeled, when in the "Enclosure slate"
   - list (with possible pictures) of factors that effect image quality or image completeness.
2) Request from CHPs: Provide a short Patient Information Handout about the Telemedicine Project.
3) Carolyn Kava – excellent CHP, has significant hearing loss. Request NSHC purchase an "Auditory Stethoscope" for her use.
4) Check with the Tech staff in Nome – the mail box when sending does NOT stop. Please check the send and receive functions.
5) During the very rushed move from the new clinic back to the old (less than "a day") none of their reference books or dictionaries were brought. Request: consider the opportunity for someone to quickly go into the new clinic and retrieve textbooks or get loners from Nome.

The CHPs are doing great with the equipment, learning it well. The patients love it too. What a wonderful tool. Thank you for the opportunity to be a part of this incredible project and travel to work with such dedicated health care providers.

Enclosed:

"Describing the Tympanic Membrane" handout
Telemedicine Skills List for each student
Telemedicine Training Evaluation – completed forms
University of Alaska Fairbanks course registration forms
Associate of Applied Science Degree –copy of each student profile

6.22

DRAFT 04/26/00

COURSE TITLE: **CHP 250 CURRENT ISSUES IN RURAL HEALTH CARE: TELEMEDICINE TECHNOLOGY (1 – 2 Credits*)**

FACULTY: Denise Statz , Alaska Federal Health Care Access Network Telehealth Trainer
4201 Tudor Centre Drive, Anchorage, Alaska 99508
Phone: 907-729-2265

Telehealth trainers will complete project orientation and telehealth training prior to presenting this course.

COURSE DESCRIPTION: Overview of telemedicine and its application in rural health care delivery. Utilization of equipment, telemedicine software and imaging equipment in the transmission of information and diagnostic images to referral centers for improved clinical assessment, patient treatment, clinical skills training and patient education.

* This course qualifies for two credits if the basic course is combined with the clinical Telemedicine courses listed below.

PREREQUISITES and RECOMMENDED PREPARATORY ACTIVITIES:

- Keyboarding tutorials
- Basic or introductory computer skills
- Telemedicine: Ear Disease Assessment, Terminology and Imaging
  CME course or self-study video and readings with pre and post test
- Telemedicine: Dermatology Assessment, Terminology and Imaging
  CME course or self-study video and readings with pre and post test

OBJECTIVES:

At the end of the course the student will:

1. Discuss the concept of telemedicine and it's application in rural health care delivery.
2. Describe the potential role of telemedicine in improving communication of visual physical examination findings between health care providers.
3. Have a working knowledge of computer equipment, telemedicine software and imaging equipment to include image capture, storing, transmission and retrieval of images and patient information.
4. Demonstrate basic computer word processing and keyboarding skills.
5. Demonstrate skills in routine quality control, maintenance and trouble shooting of computer and imaging equipment, and identify local and regional personnel and resources for solving complex problems.
6. Demonstrate effective use of telemedicine software to enter, update, file and retrieve patient demographics and case specific information.
7. Discuss patients' needs as the patient is introduced to telemedicine, focusing on confidentiality, comfort and safety with consideration to factors of age and level of education.
8. Demonstrate skill incorporating telemedicine in patient care introduction and validation of benefit of telemedicine
9. Demonstrate completion of continuous quality improvement (CQI)check sheets (*self/peer review).*
10. Review data from telemedicine utilization log (includes total number of telemedicine cases completed, total number of cases referred, case turn-around times and error log) for telemedicine planning, peer review and support, and improved clinical care.

ENT Imaging, Evaluation and Care:

11. Describe the potential impact of telemedicine in the assessment of ENT problems, related patient education, patient care management, provider communication and confirmation of findings, and review and assessment of CHA/P skills.
12. Review ear, nose and throat problem patient encounter skills including history, examination, assessment and plan in accordance with the Community Health Aide/Practitioner Manual (CHAM).

13. Using the parameters and descriptors provided in the CHAM, correctly describe normal and abnormal ear canal, tympanic membrane, nose and throat findings.
14. Demonstrate proficient use of imaging equipment to capture diagnostic images for the assessment of ENT problems.
15. Be able to describe the safe removal or ear wax, drainage and foreign bodies from the ear canal, using the special procedures of curetting, flushing and wicking, using the CHAM as a resource.
16. Demonstrate standard precautions and proper cleaning of equipment to avoid cross contamination.

Dermatology Imaging, Evaluation and Care:

17. Describe the potential impact of telemedicine in the assessment of dermatology problems, related patient education, patient care management, provider communication and confirmation of findings, and review and assessment of CHA/P skills.
18. Review dermatology specific patient encounter skills including history, examination, assessment and plan in accordance with the CHAM.
19. Using the parameters and descriptors provided in the CHAM, correctly describe abnormal dermatology findings.
20. Demonstrate proficient use of imaging equipment to capture diagnostic quality dermatology images with consideration to lighting, background, angle and distance.
21. Demonstrate standard precautions, including selection of disposable backdrop and proper cleaning of equipment to avoid cross contamination.

Imaging of other commonly encountered problems:

22. Overview of clinical considerations in capturing wound, eye, oral, joint and external genitalia images including appropriate imaging device, image content, labeling and quality control.

EKG:

22. Identify the use of EKG in baseline screening, monitoring, and acute care.
23. Adhere to CHAM, EMT and agency protocol and standing orders in identifying the sequence of care for cardiac patients (ABCs, patient at rest, administer oxygen, vital signs, appropriate hx and PE) and integration of the EKG.
24. Demonstrate proficiency in patient preparation, lead placement, data and demographics entry, recording and transmission of EKG data.
25. Identify and eliminate common sources of EKG interference: lead mis-placement, patient movement, low battery, generator, compressor, or fluorescent light.
26. Identify hardware and software solutions to on-screen errors
27. Review EKG equipment maintenance and safety protocol: device and cable inspection and storage, cleansing, battery replacement, scheduled biomedical assessment and testing.

STUDENT ACTIVITES:

Required Readings:

The rise of Acute Otitis Media Journal of American Academy of Pediatrics Volume 10, number 2, February 1997.

Care of the Child with Tympanostomy Tubes: A Visual Guide for the Pediatrician Journal Pediatrics Volume 93, number 6, June 1994.

The Natural History of a Treated Episode of Acute Otitis Media
Glen Isaacson, MD, FAAP, FACS Temple Pediatric Otolaryngology
St Christopher's Hospital For Children, Philadelphia, PA.

"Say Cheese..." Medical photography: A practical guide to taking a great picture Medical and Surgical Dermatology 6:151-154 (1999).

Physician Extender Models Reduce Cost of Telemedicine Services Telemedicine and Telehealth Networks Volume 4, number 1, February 1998.

The Acceptability of Telemedicine Among Healthcare Providers and Rural Patients
Telemedicine Today Volume 4, Issue 3 May/June 1996.

Patient Encounters using Telemedicine Equipment:

The student will complete electronic forms and images for two ear cases, two dental cases, and two dermatology cases. These may be mock patients, but complete electronic documentation and transmission of cases is required.

The student will complete electronic forms and ECG data collection for two patients. These may be mock patients, but complete electronic documentation and transmission of cases is required.

SCHEDULE: **To be completed**

MATERIALS: Student packets will include required readings, patient encounter check sheets, telemedcine skills list, training evaluation forms, and pre-test.

STUDENT EVALUATION:

1. Checklists will be used to document student's demonstration of key skills.
2. Post course written test. To pass the course requires 80% score, re-testing available upon review of course information.

COURSE GRADE: Pass/Fail

REFERENCES:

Alaska Community Health Aide/Practitioner Manual, 1998 revised edition

Body Systems and Patient Care: Interactive Computer Training for Community Health Aides and Practitioners CD-ROM, 1997 Edition

Ear Examination: A Review of the Words We Use and the Things We See CD-Rom Alaska Telemedicine Testbed Project, 1999 Edition

Ear Wax Removal Video Alaska Telemedicine Testbed Project, 1999 Edition

Telehealth Resource Manual Alaska Federal Health Care Access Network, 2000 Edition

Telehealth Quick Reference Cards Alaska Federal Health Care Access Network

OTOSCOPE

QUALITY CONTROL

Patient Positioning: Position the patient so the provider can easily see the computer screen while examining the ear.

Otoscope Placement: The otoscope should be inserted into the ear canal at a relatively flat angle, almost parallel to the floor. It is easier to achieve this if both patient and provider are at the same height, sitting in chairs.

Screen Image: The provider should see a clear image of the entire tympanic membrane on the computer screen. When a clear image is seen the image can be captured.

Brightness: A white glow (called a hot spot, or "blooming") may prevent you from seeingnecessary detail. Withdrawing the tip of the otoscope slightly (1/8 – ¼") or redirecting the tip will help reduce glare.

Self-Assessment: A self-assessment checklist can be used to help identify problems and improve patient care documentation. As your use of the equipment expands and improves you may want to change the categories.

Quality Assurance Self-Assessment Check Sheet

CHP: _____

DATE: _____

Key: Checked box indicates completion

Patient	Date of Exam	Demographic Information Complete	Comparison Image (s) Provided (Left / Right)	Is the image clear, in focus, and diagnostically useful?	Is each image clearly labeled? (right, left, front, back,)	Assessment Included
1						
2						
3						
4						
5						

This self –assessment can be used to help identify problems and improve patient care documentation. Any area above that is not checked indicates area for improvement.

Telemedicine Skills List

Participant Name: _____
Dates of Training: _____

1. Computer Skills:
   - ___ Start-up
   - ___ Log-on
   - ___ Log-off
   - ___ Shut down

2. Use of reference tools:
   - ___ CD-Rom
   - ___ Telemedicine Reference Manual
   - ___ Quick Reference Cards

3. Quality Control and Equipment Maintenance Skills:

   - ___ Demonstrate skills in routine quality control, maintenance and trouble shooting of computer, imaging and ECG equipment.
   - ___ Identify local and regional personnel and resources for complex problems.

4. Clinical Skills

   - ___ Demonstrate effective use of telemedicine software to enter, update, file and retrieve patient demographics and case specific information.
   - ___ Demonstrate proper ENT, dental and dermatology history taking and documentation in accordance with CHAM.
   - ___ Demonstrate proper clinical ear, nose, throat, dental and dermatology examinations in accordance with CHAM
   - ___ Identify use of ECG in baseline screening, monitoring, and acute care.
   - ___ Identify proper sequence of care, adherence to protocol, and integration of ECG in evaluation of cardiac patients.

   <u>ENT</u>:

   - ___ Demonstrate skill incorporating telemedicine in patient care, identifying use of telemedicine referral process.
   - ___ Using parameters and descriptors provided in the CHAM, correctly describes normal and abnormal ear canal and tympanic membrane findings.
   - ___ Demonstrate proficient use of imaging equipment to capture diagnostic images for the assessment of ENT and dental problems
   - ___ Demonstrate standard precautions and proper cleansing of equipment to avoid cross contamination.
   - ___ Demonstrate completion of CQI check sheets (*self/peer review).*

DERMATOLOGY:

___ Demonstrate proficient use of imaging equipment to capture diagnostic dermatology images, with consideration to lighting, background, angle and distance

___ Demonstrate standard precautions, including selection of disposable backdrop and proper cleansing of equipment to avoid cross contamination.

ECG

___ Demonstrate proficient use of ECG equipment to capture diagnostic data for baseline screening and the assessment of ENT and dental problems

___ Demonstrate standard precautions and proper cleansing of equipment to avoid cross contamination.

Submit to Denise Statz, ATT Project Manager
Alaska Native Health Board

Telemedicine Skills List

Participant Name: Jeanne
Dates of Training: July 21-23

1. Computer Skills:
   - Start-up
   - Log-on
   - Shut down

2. Use of reference tools:
   - CD-Rom
   - Reference Manual
   - Information Systems Help Desk (Maniilaq IS Department)

3. Clinical Skills:
   - Demonstrates proper history taking and documentation, in accordance with CHAM
   - Completes correct clinical ear examination, in accordance with CHAM
     - Using standard otoscope
     - Using telemedicine equipment
   - Using parameters and descriptors provided in the CHAM, correctly describes normal and abnormal ear canal and tympanic membrane findings.

4. Demonstrates thorough accurate use of patient/provider electronic forms.

5. Use of Digital Otoscope
   - Turn on camera
   - Focus
   - Color balance

6. Demonstrates proficient use of imaging equipment to capture diagnostic image for the assessment of ear disease.

7. Demonstrate effective use of telemedicine software to enter, update, file and retrieve patient demographics and case specific information.

8. Demonstrate skills in routine maintenance and trouble shooting of computer and imaging equipment.

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Submit to Denise Statz, ATT Project Manager
Alaska Native Health Board

Telemedicine Skills List

Participant Name: Arlene Saccheus
Dates of Training: July 21-23, 1999

1. Computer Skills:
   - Start-up ✓
   - Log-on ✓
   - Shut down ✓

2. Use of reference tools: ✓
   - CD-Rom
   - Reference Manual
   - Information Systems Help Desk (Maniilaq IS Department)

3. Clinical Skills:
   Demonstrates proper history taking and documentation, in accordance with CHAM ✓

   Completes correct clinical ear examination, in accordance with CHAM
   - Using standard otoscope
   - Using telemedicine equipment ✓

   Using parameters and descriptors provided in the CHAM, correctly describes normal and abnormal ear canal and tympanic membrane findings.

4. Demonstrates thorough accurate use of patient/provider electronic forms.

5. Use of Digital Otoscope
   - Turn on camera ✓
   - Focus ✓
   - Color balance

6. Demonstrates proficient use of imaging equipment to capture diagnostic image for the assessment of ear disease. ✓

7. Demonstrate effective use of telemedicine software to enter, update, file and retrieve patient demographics and case specific information. ✓

8. Demonstrate skills in routine maintenance and trouble shooting of computer and imaging equipment.

Submit to Denise Statz, ATT Project Manager
Alaska Native Health Board

Telemedicine Skills List

Participant Name: Lillian Amaktoolik
Dates of Training: July 21-23, 1999

1. Computer Skills:
   - Start-up
   - Log-on
   - Shut down

2. Use of reference tools:
   - CD-Rom
   - Reference Manual
   - Information Systems Help Desk (Maniilaq IS Department)

3. Clinical Skills:
   Demonstrates proper history taking and documentation, in accordance with CHAM

   Completes correct clinical ear examination, in accordance with CHAM
   - Using standard otoscope
   - Using telemedicine equipment

   Using parameters and descriptors provided in the CHAM, correctly describes normal and abnormal ear canal and tympanic membrane findings.

4. Demonstrates thorough accurate use of patient/provider electronic forms.

5. Use of Digital Otoscope
   - Turn on camera
   - Focus
   - Color balance

6. Demonstrates proficient use of imaging equipment to capture diagnostic image for the assessment of ear disease.

7. Demonstrate effective use of telemedicine software to enter, update, file and retrieve patient demographics and case specific information.

8. Demonstrate skills in routine maintenance and trouble shooting of computer and imaging equipment.

Telemedicine Training Evaluation

1. Was the information presented in a way that you could understand...
   a. the trainer? yes
   b. the Resource Manual? yes

Comments:

2. Was the training (circle one)
   a. too long?
   b. too short?
   (c.) just right?

Comments:

3. Can you comfortably and independently...
   a. use the smart form, typing in the patient/provider information? probably
   b. use the otoscope? yes
   c. use the otoscope to capture an image? yes
   d. send the information? probably

Comments:

4. What did you like best about this training? Taking pictures

5. What can we do to improve training to make it more useful?

Telemedicine Training Evaluation

1. Was the information presented in a way that you could understand...
   a. the trainer? Yes
   b. the Resource Manual?

Comments:

2. Was the training (circle one)
   a. too long?
   b. too short? a little too short
   c. just right?

Comments:

3. Can you comfortably and independently...
   a. use the smart form, typing in the patient/provider information? Yes
   b. use the otoscope? Yes
   c. use the otoscope to capture an image? Yes
   d. send the information? Yes need more practice sending w/ images

Comments:

4. What did you like best about this training?
   The new equipment

5. What can we do to improve training to make it more useful?
   more one on one

Telemedicine Training Evaluation

1. Was the information presented in a way that you could understand...
    a. the trainer? yes
    b. the Resource Manual? yes

Comments: very straight forward

2. Was the training (circle one)
    a. too long? NO
    b. too short? NO
    c. just right? yes

Comments: enjoyed the time

3. Can you comfortably and independently...
    a. use the smart form, typing in the patient/provider information? yes
    b. use the otoscope? yes
    c. use the otoscope to capture an image? yes
    d. send the information? yes

Comments:

4. What did you like best about this training? cool stuff

5. What can we do to improve training to make it more useful? ?

Community Health Aide/Practitioner
Student Course Profile
Associate of Applied Science Degree

Date _____
Update _____
Update _____

Name Carolyn Kava Social Security # 574-30-2016
Village Savoonga Health Corporation NSHC
Local University of Alaska Campus: UAF
TABE Scores: Reading _____ Comprehension _____ Math _____

Requirements: All credits for the A.A.S. degree must be at the 100-level or above and be distributed as follows

	CREDIT	GRADE	DATE
COMMUNICATION (9 Credits)			
ENGL 111X-Methods of Written Communication	3		
ENGL 211X-Intermediate Exposition with Modes of Literature OR ENGL 212-Business, Grant and Report Writing * OR ENGL 213X-Intermediate Exposition	3		
SPC 131X-Fundamentals of Oral Communication: Group Context OR SPC 141X-Fundamentals of Oral Communication: Public Context	3		
MATHEMATICS OR NATURAL SCIENCE (3 Credits)			
A math or natural science course at the 100-level or above	3		
HUMANITIES, SOCIAL SCIENCES, MATH, OR NATURAL SCIENCES			
One (1) course in any of the above subjects	3		
MAJOR SPECIALITY REQUIREMENTS - Community Health Aide			
CHP 131 (or CHP 110) CHA, Session I HS 100	(8)	B Pass	'84
CHP 132 CHA, Session II (not required if completed CHP 111) HS 112	(8)	A	'86
CHP 133 (or CHP 111 Old Session II) CHA, Session III	8		
CHP 134 (or CHP 112 Old Session III) CHA, Session IV HS 113	(8)	A	'86
CHP 135 (or CHP 124) CHA, Preceptorship	2		
Five (5) or more Credits at the CHP, HEALTH or EMS 200 LEVEL			
See UAF/ local campus Catolog or your Health Corp. for specific courses			
CHP 203-Clinical Update for CHPs (1-3)			
CHP 206-Mental Health/Substance Abuse (1-3) = HS 206 (2-A '87)	2	A	'87
CHP 207-Maternal and Infant Health (1-3)			
CHP 208-Communicable Disease (1-3)			
CHP 211-Health Education (1-3)			
CHP 212-Diabetes: Primary Prevention and Village Care (1-3)			
CHP 293-Special Topic Courses (1-3) CHP 250 (1-Pass '99)	1	P	99
Six (6) Credits of ELECTIVES *If took CHP 110-124 series need 8 more credits*			
HS 193 CHAT (1-P '83)			
HS 194 EIT (1-P '83)			
EMTT			

ENGL 111 and a 200 level course meets MEDEX PA School requirements

TOTAL 60 CRED

*ENGL 212 does not fulfill the second half of the written communication requirement for the baccalaureate degree

= UAF Certificate in Community Health

CHP 4

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Community Health Aide/Practitioner
Student Course Profile
Associate of Applied Science Degree

Date 6/20/99
Update _____
Update _____

Name Wanda I. Okoomealingok Social Security # 574-30-9423
Village Savoonga Health Corporation NSHC
Local University of Alaska Campus: UAF Northwest Campus
TABE Scores: Reading _____ Comprehension _____ Math _____

Requirements: All credits for the A.A.S. degree must be at the 100-level or above and be distributed as follows

	CREDIT	GRADE	DATE
COMMUNICATION (9 Credits)			
ENGL 111X-Methods of Written Communication ... Eng 111	(3)	B	'88
ENGL 211X-Intermediate Exposition with Modes of Literature OR			
ENGL 212-Business, Grant and Report Writing * OR			
ENGL 213X-Intermediate Exposition ... Eng 213	(3)	B	'89
SPC 131X-Fundamentals of Oral Communication: Group Context OR			
SPC 141X-Fundamentals of Oral Communication: Public Context ... Spch 111	(3)	B	'88
MATHEMATICS OR NATURAL SCIENCE (3 Credits)			
A math or natural science course at the 100-level or above ... Biol 102	(3)	D	'90
HUMANITIES, SOCIAL SCIENCES, MATH, OR NATURAL SCIENCES			
One (1) course in any of the above subjects ... Psy 150 Human Development	(3)	C	'88
MAJOR SPECIALITY REQUIREMENTS - Community Health Aide			
CHP 131 (or CHP 110) CHA, Session I ... CHP 131	(8)	Pass	7 '94
CHP 132 CHA, Session II (not required if completed CHP 111) CHP 132	(8)	Pass	5 '95
CHP 133 (or CHP 111 Old Session II) CHA, Session III	8		
CHP 134 (or CHP 112 Old Session III) CHA, Session IV ... CHP 134	(8)	P-?	5 '96
CHP 135 (or CHP 124) CHA, Preceptorship	2		
Five (5) or more Credits at the CHP, HEALTH or EMS 200 LEVEL			
See UAF/ local campus Catolog or your Health Corp. for specific courses			
CHP 203-Clinical Update for CHPs (1-3)			
CHP 206-Mental Health/Substance Abuse (1-3)			
CHP 207-Maternal and Infant Health (1-3)			
CHP 208-Communicable Disease (1-3)			
CHP 211-Health Education (1-3)			
CHP 212-Diabetes: Primary Prevention and Village Care (1-3)			
CHP 293-Special Topic Courses (1-3) ... CHP 250 (1 - Pass 197) CHP 250 Telemed (1 - P 199)			
Six (6) Credits of ELECTIVES *If took CHP 110-124 series need 8 more credits*			
EMS 135 Aeromed Evac (1 - Pass 197)			
Art 105 Drawing (3 - B 88)			
PE 246 Adv First Aid (3 - B '93)			
+ Lots of credits			

= UAF Certificate in Community Health

ENGL 111 and a 200 level course meets MEDEX PA School requirements

*ENGL 212 does not fulfill the second half of the written communication requirement for the baccalaureate degree

TOTAL 60 CREDIT

CHP 4/97

6.36

Community Health Aide/Practitioner
Student Course Profile
Associate of Applied Science Degree

Date 6/20/99
Update _____
Update _____

Name Elsie J. Pelowook Social Security # 574-74-3021
Village Savoonga Health Corporation NSHC
Local University of Alaska Campus: UAF _____
TABE Scores: Reading _____ Comprehension _____ Math _____

Requirements: All credits for the A.A.S. degree must be at the 100-level or above and be distributed as follows

	CREDIT	GRADE	DATE
COMMUNICATION (9 Credits)			
ENGL 111X-Methods of Written Communication	3		
ENGL 211X-Intermediate Exposition with Modes of Literature OR ENGL 212-Business, Grant and Report Writing * OR ENGL 213X-Intermediate Exposition	3		
SPC 131X-Fundamentals of Oral Communication: Group Context OR SPC 141X-Fundamentals of Oral Communication: Public Context	3		
MATHEMATICS OR NATURAL SCIENCE (3 Credits)			
A math or natural science course at the 100-level or above	3		
HUMANITIES, SOCIAL SCIENCES, MATH, OR NATURAL SCIENCES			
One (1) course in any of the above subjects	3		
MAJOR SPECIALITY REQUIREMENTS - Community Health Aide			
CHP 131 (or CHP 110) CHA, Session I CHP 131	(8)	Pass	7 94
CHP 132 CHA, Session II (not required if completed CHP 111) CHP 132	(8)	Pass	Sp 9
CHP 133 (or CHP 111 Old Session II) CHA, Session III	8		
CHP 134 (or CHP 112 Old Session III) CHA, Session IV	8		
CHP 135 (or CHP 124) CHA, Preceptorship CHP 135	(2)		
Five (5) or more Credits at the CHP, HEALTH or EMS 200 LEVEL			
See UAF/ local campus Catolog or your Health Corp. for specific courses			
CHP 203-Clinical Update for CHPs (1-3)			
CHP 206-Mental Health/Substance Abuse (1-3)			
CHP 207-Maternal and Infant Health (1-3)			
CHP 208-Communicable Disease (1-3)			
CHP 211-Health Education (1-3)			
CHP 212-Diabetes: Primary Prevention and Village Care (1-3)			
CHP 293-Special Topic Courses (1-3)			
Six (6) Credits of ELECTIVES *If took CHP 110-124 series need 8 more credits*			
CHP 106 Nurse Aid (3-8 '94)			

= UAF Certificate in Community Health

ENGL 111 and a 200 level course meets MEDEX PA School requirements

TOTAL 60 CRE

*ENGL 212 does not fulfill the second half of the written communication requirement for the baccalaureate degree

CHP

6.37

Community Health Aide/Practitioner
Student Course Profile
Associate of Applied Science Degree

Date 6/18/99
Update _____
Update _____

Name Maryann P Wongittilin Social Security # 574-48-4965
Village Savoonga Health Corporation NSHC
Local University of Alaska Campus: UAF _____
TABE Scores: Reading _____ Comprehension _____ Math _____

Requirements: All credits for the A.A.S. degree must be at the 100-level or above and be distributed as follows

	CREDIT	GRADE	DATE
COMMUNICATION (9 Credits)			
ENGL 111X-Methods of Written Communication	3		
ENGL 211X-Intermediate Exposition with Modes of Literature OR			
ENGL 212-Business, Grant and Report Writing * OR			
ENGL 213X-Intermediate Exposition	3		
SPC 131X-Fundamentals of Oral Communication: Group Context OR			
SPC 141X-Fundamentals of Oral Communication: Public Context	3		
MATHEMATICS OR NATURAL SCIENCE (3 Credits)			
A math or natural science course at the 100-level or above	3		
HUMANITIES, SOCIAL SCIENCES, MATH, OR NATURAL SCIENCES			
One (1) course in any of the above subjects	3		
MAJOR SPECIALITY REQUIREMENTS - Community Health Aide			
CHP 131 (or CHP 110) CHA, Session I HS 100	8	B	7'87
CHP 132 CHA, Session II (not required if completed CHP 111)	8		
CHP 133 (or CHP 111 Old Session II) CHA, Session III HS 112	8	B	88
CHP 134 (or CHP 112 Old Session III) CHA, Session IV CHP 122 (III)	~~8~~ 4	B	'92
CHP 135 (or CHP 124) CHA, Preceptorship CHP 124	2	Pass	'93
CHP 123	14	Pass	'93
Five (5) or more Credits at the CHP, HEALTH or EMS 200 LEVEL			
See UAF/ local campus Catolog or your Health Corp. for specific courses			
CHP 203-Clinical Update for CHPs (1-3)			
CHP 206-Mental Health/Substance Abuse (1-3)			
CHP 207-Maternal and Infant Health (1-3)			
CHP 208-Communicable Disease (1-3)			
CHP 211-Health Education (1-3)			
CHP 212-Diabetes: Primary Prevention and Village Care (1-3)			
CHP 293-Special Topic Courses (1-3) CHP 250 Telemed	1		'99
Six (6) Credits of ELECTIVES *If took CHP 110-124 series need 8 more credits*			
CHP 108 Nurse Aid (3-Pass '92)			
EMT 107 ETT (2-B '87)			

= UAF Certificate in Community Health

ENGL 111 and a 200 level course meets MEDEX PA School requirements _____ TOTAL 60 CREDI

*ENGL 212 does not fulfill the second half of the written communication requirement for the baccalaureate degree

CHP 4/

6.38

Telemedicine Training Report
Selawik and Noorvik

C. R. Kuhnley, March 1999

Telemedicine Training Report

Thank you very much for the opportunity to provide this training. I appreciate how hard each of you worked to set up the equipment and training process. Your support and problem-solving patience were also very much appreciated!

I believe the Health Aides in Selawik and Noorvik are very enthusiastic and interested in using telemedicine for their patient encounters. They are enthusiastic about using the equipment and dedicated to improving their imaging skills and maintaining quality assurance. This outstanding computer program and technology will enhance the quality of care for the patients in their communities.

Selawik Clinic

Students Trained:

Krystal Hall
Florence Mitchell

Summary of Activities

Before beginning the training process it was good to take time to ask the Health Aides what had been happening in their clinic.

They had had a busy and exhausting physician visit in the past week, and two weeks of intensive care for flu patients. In addition, they had experienced a recent traumatic death of a respected elder who died in their clinic as a result of extensive burns. The training I had received in critical incident stress debriefing was helpful in supporting the Health Aides.

As a recommendation for training, I feel strongly that the trainer take time to become acquainted with Health Aide workload, experiences and environment before undertaking training for any new skills. It is also helpful to find out their feelings about previous training and the training you will be providing.

We followed the lesson plan closely. The lesson plan is effective and efficient in providing skills-building activities that result in knowledge and beginning skills mastery that will improve with practice beyond training.

Krystal and Florence - and Emma, when she could join us - were attentive to the information and enthusiastic about their new skills. They practiced eagerly.

Difficulties encountered:

1. Signing on to activate the program: resolved with calling for information re: village password. This was not in my notes or in village paperwork – resulted in delay in starting training.
2. System lock-up, lack of response to keyboard: resolved with conversations with Kotzebue technicians, checking connections, and finally, with turning the equipment on and off three times. All data entered each time, including images, was lost. This was disappointing to the Health Aides and inefficient for the amount of rework involved, as well as loss of patients.
3. No light to otoscope – resolved in verifying directions from manual, and finally, talking with Stewart by phone and holding on-button switch for at least 30 seconds.
4. Transmission of images to Kotzebue - images sent as directed by manual but not received in Kotzebue – resolved by discussions with Kotzebue technicians and their troubleshooting in at the hospital.
5. I did not understand how to access cases we had created on database – not resolved until Noorvik visit.
6. CD ROM information was not included in clinic boxes and was not received during training.

We had patients waiting when the system lock-up and otoscope light difficulties were encountered. There was a time delay in making contact and troubleshooting the system. The patients declined to wait longer than 30 minutes.

During the evaluation, Florence told me she had not wanted to undertake the training but that she had had fun and looked forward to using the equipment daily with patients.

Noorvik Clinic

Students Trained:

Valeria Black
Sally Harvey
Amy Carter

Summary of Training Activities:

Once again, the CHA/P's had professional and personal issues that affected training, especially on the first day training was planned. Valeria went through a good deal of the lesson plan independently that day and practiced all of the skills. She was a quick learner. Her best test images did not transmit to Kotzebue. At 5pm that afternoon we received feedback from a Kotzebue physican on the images which were actually received.

On the following day, all of the available Health Aides attended training and quickly picked up the skills using the lesson plan and the manual. They were enthusiastic about recruiting patients, and filled out forms for each test patient, as well as had the patient fill out satisfaction forms. They learned quickly and were diligent about practicing throughout the day. Florence Mitchell, who had just had the training, shared her knowledge and experience. This facilitated the learning process.

Difficulties encountered:

1. Weather delays – Sunday, Monday and Tuesday were spent waiting for weather at the Bering Air facility.
2. Health Aide availability: one Health Aide went home sick at 2:30 p.m.Tuesday; two Health Aides were on sick leave on Tuesday, and one had not returned from leave.
3. System lock-up: resolved by shutting down and subsequently losing all data input. In Noorvik the system would generally respond after only one or two complete shut-downs, rather than three.
4. Incorrect image transmission: resolved by troubleshooting with Stewart – I did not understand that images could be transmitted in the "capture live video" mode only.
5. Fundamental lack of understanding on my part of how to access cases for the village database: resolved in talking with Stewart, who explained that the cases were accessed only from the "Sent" window. I reviewed all of my notes and my training – this was not made clear during my training and was a source of frustration, as well as my not being able to initally teach the Health Aides how to access the cases.
6. CD ROM with training information was not received – Bering Air had no record of receipt and stated they did not have a package for me for Selawik or Noorvik during the training period:

not resolved. I hope this information can be reviewed with the Health Aides and each clinic can receive a copy – it will be very helpful information.

7. Verbal feedback from physician to me, but not to Health Aides: resolved by asking physician to comment via the computer program and call and speak with the Health Aide sending the image. It is critical that this communication link and feedback loop be undertaken to foster the best working relationship and quality assurance.

The physicians and Health Aides seem to have a very positive working relationship that I believe will increase as a result of this technology.

I perceived that some Health Aides were a little reluctant to undertake training and had reservations about daily use of the equipment. Some of that reluctance seemed to stem from an unfamiliarity with computers and data input. When they experienced how easy it was to use the Smart Form and how much better they could assess ear problems, they became enthusiastic about using the equipment. They initiated several patient encounters, completing consent and satisfaction forms and steadily improving the quality of images. One Health Aide even initiated the use of the digital camera for a very sick patient. When the image was transmitted, the physician decided to admit the patient to the hospital in Kotzebue. That experience heightened everyone's interest – Health Aide and physician alike - in using this important tool for patient care.

The Health Aides said the things they liked best about the training were that the lesson plan and manual made it easy to learn. They felt comfortable practicing skills in front of the trainer, and they quickly became comfortable with entering data and handling the otoscope safely and in ways to improve the quality of their TM images. They indicated they are interested in continuing to use the technology and improve with their skills. They especially like the feedback from the physicians.

BUILDING CARTS FOR KOTZEBUE

Steps for building carts:

1. **Be sure to understand which cart is being assembled** - there are three different types of carts. The following chart describes which carts (and color) are to be assembled at each location:

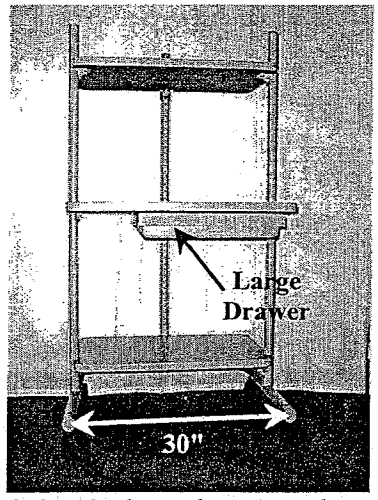
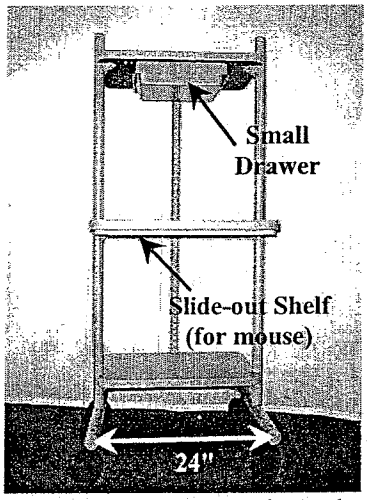
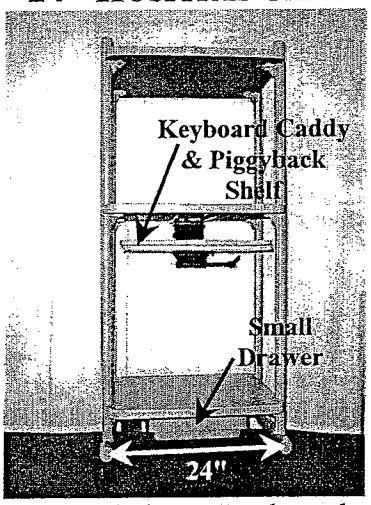
LOCATION	TYPE OF CART
Ambler	24" Clinic cart, Color: Light Grey
Buckland Deering	24" Clinic cart, Color: Wood Grain
Kobuk Shungnak	30" Clinic cart, Color: Black (Black tubes)
Kivalina	30" Clinic cart, Color: Bone (Putty Grey tubes)
Kiana Noatak Selawik	30" Clinic cart, Color: Light Grey (Putty Grey tubes)
Noorvik	30" Clinic cart, Color: Wood Grain (Black tubes)
Kotzebue	24" Hospital cart, Color: Light Grey (Putty Grey tubes)

   - Check to make sure all boxes arrived for the carts (generally, 6 boxes should arrive for the cart).
   - Check to make sure all the boxes arrived for the equipment to put on the cart.
   - Check to make sure the toolkit is available.

2. **Work first on the undersides of shelves before assembling carts.** This involves installing any drawers, keyboard shelves, and slide out shelves. When pre-drilling any holes using the 1/8" drill bit - do not drill all the way through the wood, but instead drill 3/4" into the wood. Note the following:
   - The large shelf for both the 24" and 30" clinic carts is the middle shelf. The basic "cart kit" includes a second smaller shelf. An extra shelf was also ordered for these carts -- which is the same size as this smaller shelf. The two smaller shelves will be used as the top and bottom shelf.
   - For the 24" hospital cart, all the shelves are the same size. The "basic kit" includes two shelves, and an extra shelf was also ordered.
   - **It is possible to "pre-drill" the holes for the monitor and CPU before assembling the cart.** If so, follow the instructions for steps 5 and 6 (without actually mounting the equipment) prior to doing the next step.
3. **Assemble the carts following the Anthro instruction manual and these instructions.** Connect the 20" extension tubes to the cart when adding the top shelf. Use the attached photographs and diagrams to determine the exact heights for the attaching the shelves.
4. **Use the template for the monitor to drill the holes for the monitor** (see instructions later) and install the monitor and the swivel base.
5. **Use the template for the CPU** (included inside the CPU case) to drill the holes for CPU (see instructions later) and bolt the CPU to the cart.
6. **Install the battery backup.**
7. **Install the speakers.**
8. **Install the keyboard, mouse and microphone.**
9. **Install the printer and otoscope.**
10. **Install wiring.**
11. **Install power cables.**
12. **Install cable management.**
13. **Place all required equipment (e.g. otoscope probe and cables) in the drawer.**
14. **After testing the equipment, roll the cart into its final position and place the dust cover over the cart.**

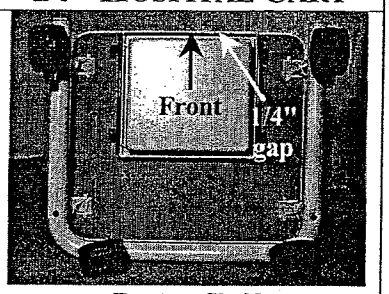
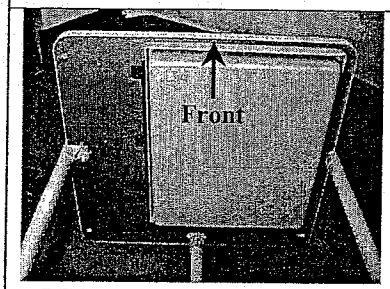
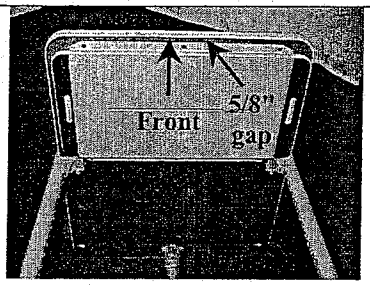
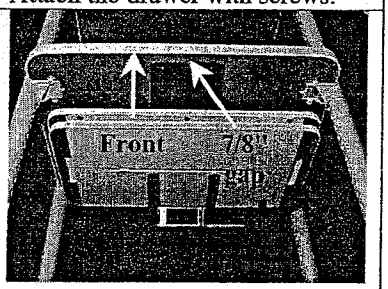
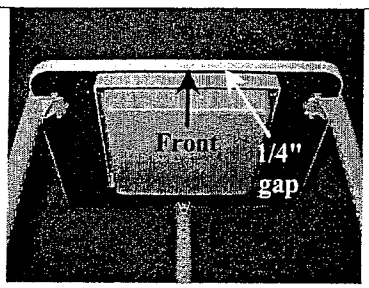
BUILDING CARTS FOR KOTZEBUE

STEP #1: Differences between carts

30" CLINIC CART	24" CLINIC CART	24" HOSPITAL CART
		
Only the large drawer needs to be added to the large middle shelf. The top and bottom shelf are the same size, and are smaller than the middle shelf.	The small drawer needs to be added to the top shelf, and the "slide-out" shelf needs to be added to the large middle shelf. The top and bottom shelf are the same size, and are smaller than the middle shelf.	The small drawer needs to be added to the bottom shelf, and the keyboard caddy (with an attached "piggyback shelf") needs to be added to the middle shelf. All shelves are the same size.

BUILDING CARTS FOR KOTZEBUE

STEP #2: Work on Shelves Before Assembling Cart

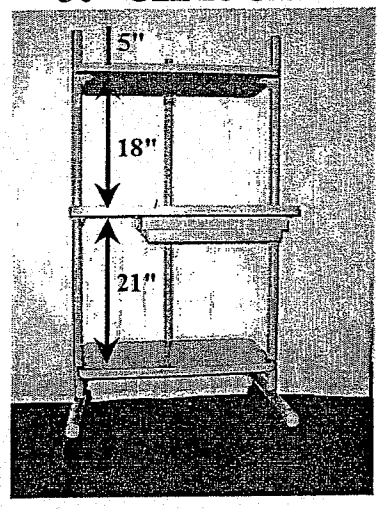
30" CLINIC CART	24" CLINIC CART	24" HOSPITAL CART
		 **Bottom Shelf** Center the small drawer along the front edge of the shelf. Position the drawer about 1/4" back from the front edge. Mark holes, then pre-drill with 1/8" drill bit. Attach the drawer with screws.
 **Middle Shelf - (Large Shelf)** Be sure the shelf supports are attached to the shelf first. Position the large drawer along the front edge and very near the right edge (as viewed from the front) of the shelf. The drawer's right rear mounting bracket should directly in front and up against the right shelf support. Mark holes, then pre-drill with 1/8" drill bit. Attach the drawer with screws	 **Middle Shelf - (Large Shelf)** Be sure the shelf supports are attached to the shelf first. Center the metal tray near the front edge of the shelf. The back edge of the metal tray should be up against the shelf supports and the front edge 5/8" from the front edge of the shelf.	 **Middle Shelf** Attach the piggyback shelf to the keyboard caddy (following the "*Keyboard Caddy and Piggyback Mouse Shelf*" instructions). At step 6 of the instructions, center the track on the middle shelf and position it 7/8" back from the front edge of the shelf. Mark holes and pre-drill with 1/8" drill bit. Complete rest of instructions.
	 **Top Shelf** Center the small drawer along the front edge of the shelf. Position the drawer about 1/4" back from the front edge. Mark holes, then pre-drill with 1/8" drill bit. Attach the drawer with screws.	

BUILDING CARTS FOR KOTZEBUE

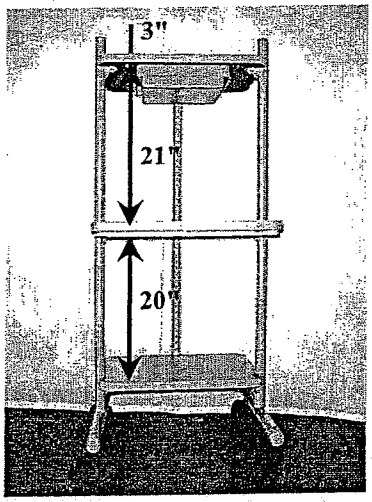
STEP #3a: Spacing Between Shelves (Photographs)

(See Anthro instructions for assembling cart frame)

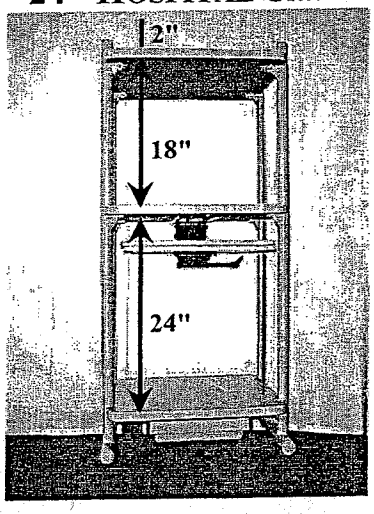
30" CLINIC CART



24" CLINIC CART



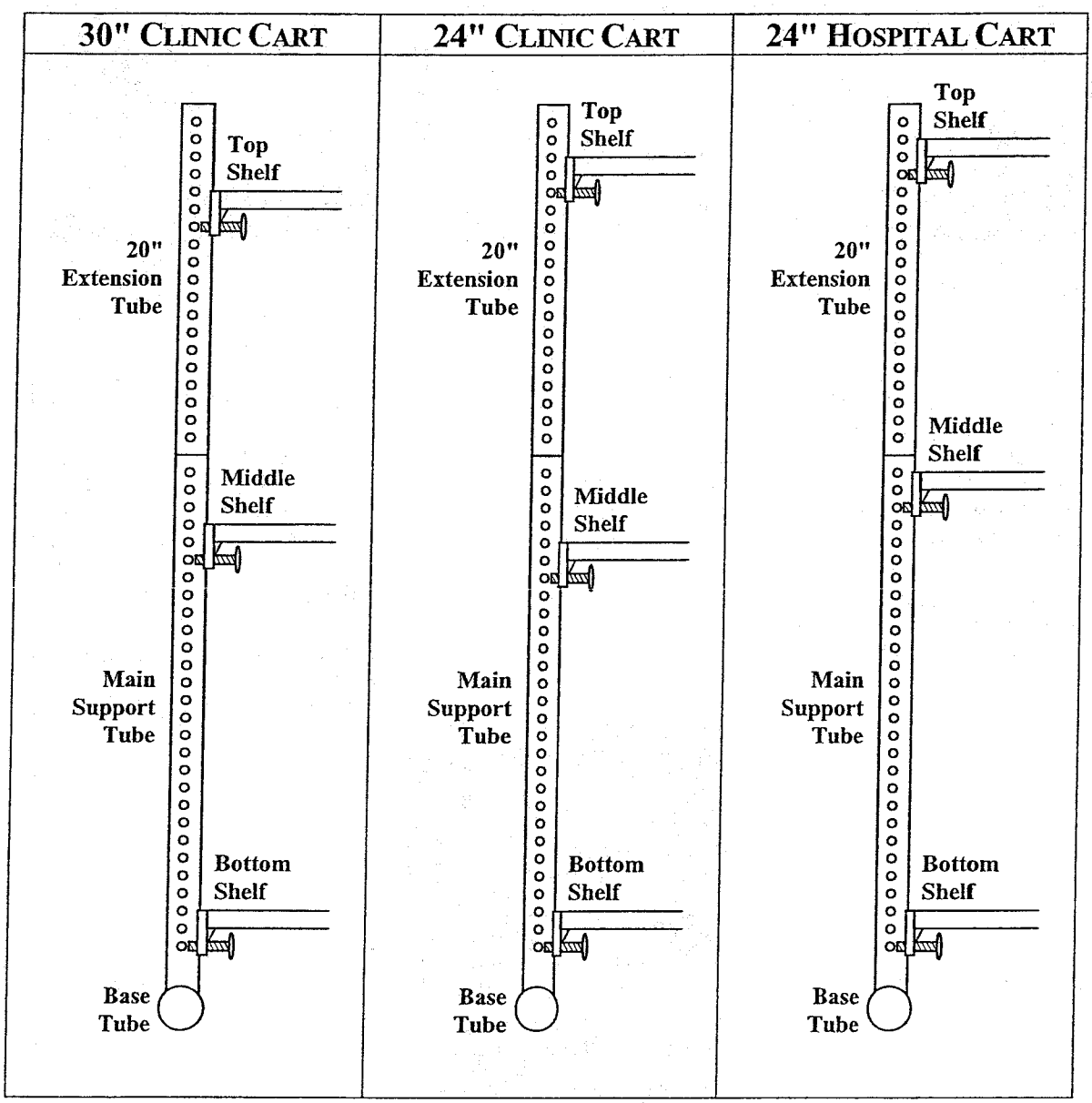
24" HOSPITAL CART



BUILDING CARTS FOR KOTZEBUE

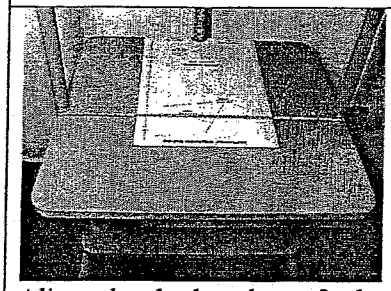
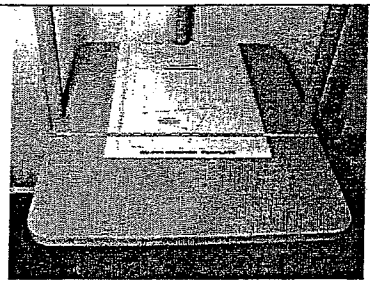
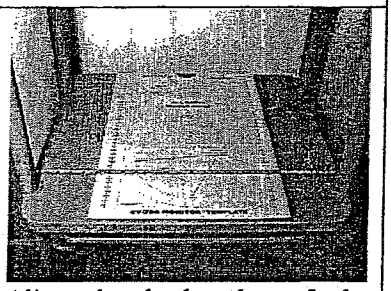
STEP #3b: Spacing Between Shelves (Diagrams)

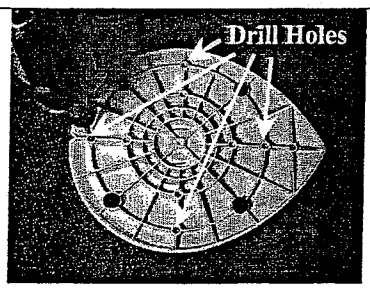
(See Anthro instructions for assembling cart frame)



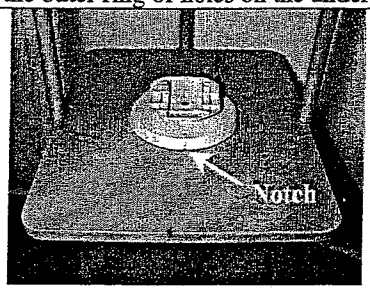
BUILDING CARTS FOR KOTZEBUE

STEP #4: Install the monitor

30" CLINIC CART	24" CLINIC CART	24" HOSPITAL CART
		
Align the back edge of the monitor template along the back edge of the middle shelf. Center template around rear pole and use tape measure to center front of template. Mark the drill holes with a marker then remove the template. **NOTE: PULL THE LARGE DRAWER ALL THE WAY OUT BEFORE DRILLING HOLES** (to stop the wood shavings dropping into the drawer). Drill 1/8" holes all the way through the shelf.	Align the back edge of the monitor template along the back edge of the middle shelf. Center template around rear pole and use tape measure to center front of template. Mark the drill holes with a marker then remove the template. **NOTE: PULL OUT THE "SLIDE OUT SHELF" AS FAR AS IT GOES BEFORE DRILLING HOLES** (to prevent drilling a hole in it). Drill 1/8" holes all the way through the shelf.	Align the back edge of the monitor template along the back edge of the middle shelf. Center template using tape measure to center front and back of template. Mark the drill holes with a marker then remove the template. Drill 1/8" holes all the way through the shelf. **NOTE: THE TWO HOLES ALONG THE CENTER LINE WILL NOT PUNCH ALL THE WAY THROUGH DUE TO THE METAL SLIDE BELOW. PULL OUT THE KEYBOARD CADDY TO PREVENT DRILLING HOLES IN IT.**

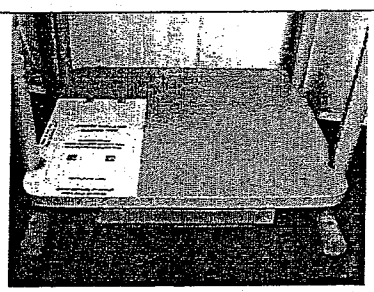


Drill 1/4" holes all the way through the outer ring of holes on the underside of the monitor "swivel base".

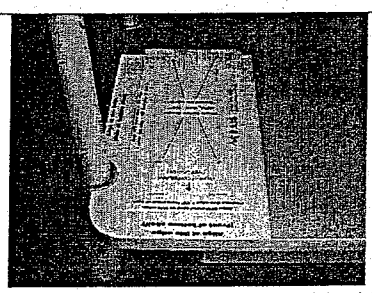


Using four Phillips-head (#10, 2") screws, attach the monitor "swivel base" to the middle shelf. Note the "front" versus the "back" of the base (here, the base has a notch at the front). Be careful not to tighten the screws too much, otherwise the monitor "swivel base" may crack. (Shown above is the 24" clinic cart ... all other carts are similar). Attach the monitor to the "swivel base", sliding it back on the base until to lock it in place. **NOTE: THE MONITOR MUST CLICK INTO PLACE TO BE SECURE ON THE BASE.**

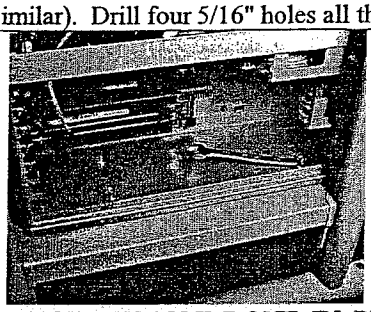
STEP #5: Install the CPU



Align the front edge of the CPU template along the front and left edges of the lower shelf. The template has a cutout to position around the pole as shown above. (Shown above is the 24" clinic cart ... all other carts are similar).



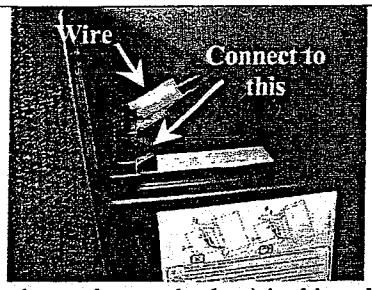
On top of this template, place the template from the CPU (located inside the CPU case during shipment) in the marked rectangle. Mark the drill holes with a marker then remove the template. (Shown above is the 24" clinic cart ... all other carts are similar). Drill four 5/16" holes all the way through the shelf.



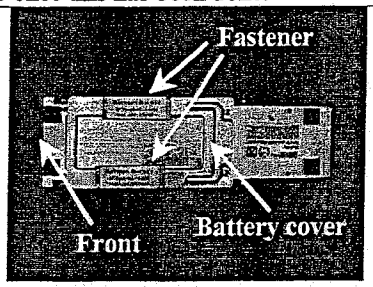
NOTE: OPEN THE CPU SIDE COVER (IF NOT DONE IN PREVIOUS STEP TO GET THE TEMPLATE) AND THEN REMOVE THE MODEM CARD FROM THE LAST SLOT IN THE CPU BEFORE DOING THIS STEP. Push four 1 1/2" bolts up through the wood shelf from the bottom, and shift the CPU case around until all four fit through the drilled holes in the case. It may not be possible on the 24" Hospital cart to get all four bolts through - in which case use only three. Place a locking washer and nut on each bolt, and use the wrench to tighten the nuts. **DO NOT OVERTIGHTEN THE NUTS. BE EXTREMELY CAREFUL NOT TO DAMAGE THE COMPUTER ELECTRONIC. REMEMBER TO REPLACE THE MODEM CARD AND THE COVER ON THE CPU CASE.**

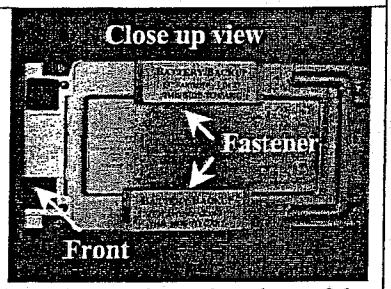
BUILDING CARTS FOR KOTZEBUE

STEP #6: Install the battery backup



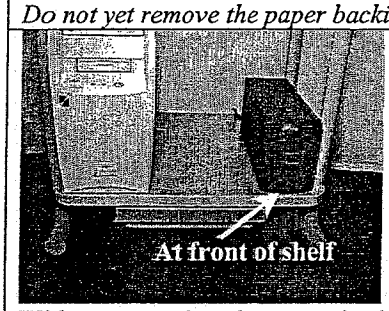
The UPS (uninterruptable power supply - or battery backup) is shipped with an internal wire disconnected. Follow the instructions on the power supply case to connect this wire. Remove the yellow instruction diagram from the outside of the case once this has been done.

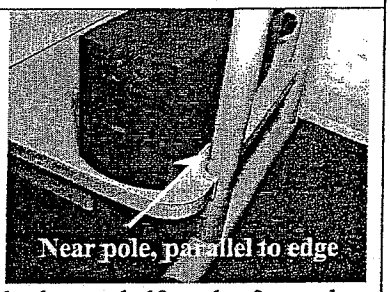




Stick the Fasteners labeled "Battery Backup" to the UPS underside, attaching them only to the edges of the removable cover for the battery compartment. Shown above is the underside of the battery backup, and a close-up of the battery cover.

NOTE: Attach the side of the fastener that is not labeled to the equipment by removing the paper backing. Do not yet remove the paper backing with the label.





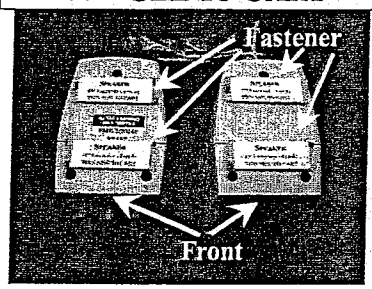
Without removing the paper backing, position the battery backup on the lower shelf at the front edge. Make sure the battery backup lies parallel to the side of the shelf, and is very close to (but not touching) the cart poles. Then remove the paper backing with the label, and very carefully place the battery backup into position. The adhesive is non-removable, so only lower the battery backup onto the shelf once the position is correct.

NOTE: Always position the equipment in the correct location before removing the paper backing. Once you are sure of the location, remove the paper backing with the label and press the equipment into place. Be careful - the adhesive sticks very firmly to the cart, with no chance for re-positioning the equipment. After sticking to the cart, make sure the equipment is securely positioned and does not move.

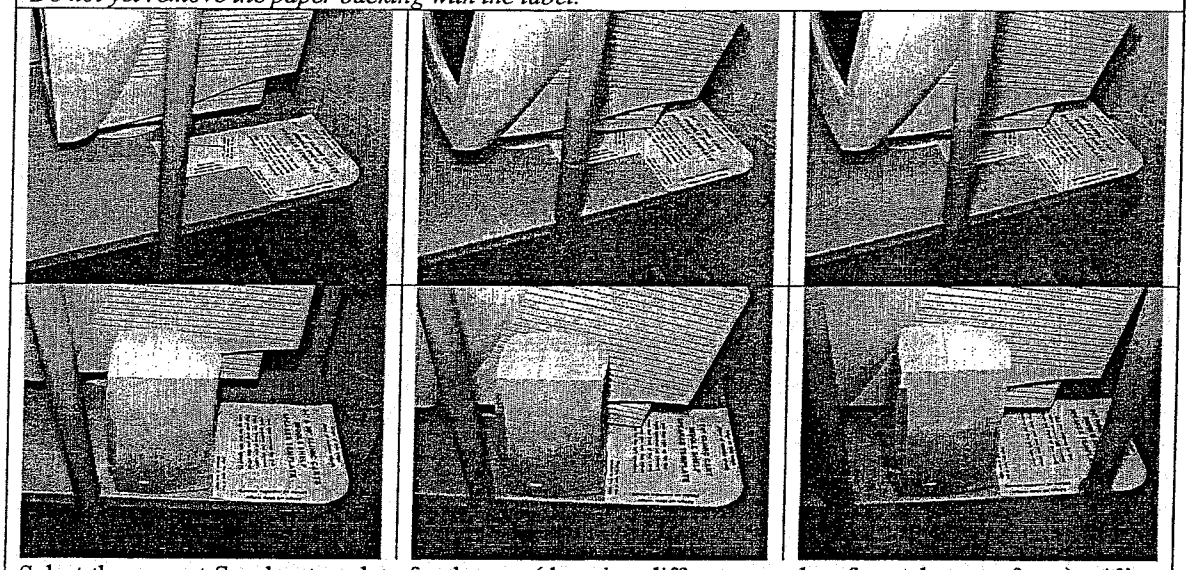
BUILDING CARTS FOR KOTZEBUE

STEP #7: Install the speakers

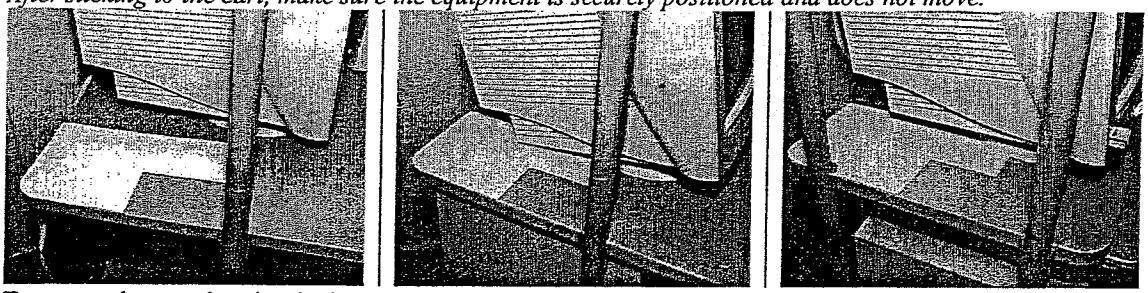
30" CLINIC CART	24" CLINIC CART	24" HOSPITAL CART



Stick two Fasteners labeled "Speaker" to the underside of each speaker, positioning one fastener near the front of the speaker and one near the rear. Shown above is the underside of both speakers.
NOTE: Attach the side of the fastener that is not labeled to the equipment by removing the paper backing. Do not yet remove the paper backing with the label.



Select the correct Speaker template for the cart (there is a different template for each type of cart). Align the edges of the template along the back and right edges of the middle shelf (with the monitor) as shown above. Without removing the paper backing, position the **speaker with the volume controls** in the cutout in the template (aligning the back and inside edge of the speaker with the cutout). Then remove the paper backing with the label, and very carefully place the speaker into position. The adhesive is non-removable, so only lower the speaker onto the shelf once the position is correct.
NOTE: Always position the equipment in the correct location before removing the paper backing. Once you are sure of the location, remove the paper backing with the label and press the equipment into place. Be careful - the adhesive sticks very firmly to the cart, with no chance for re-positioning the equipment. After sticking to the cart, make sure the equipment is securely positioned and does not move.

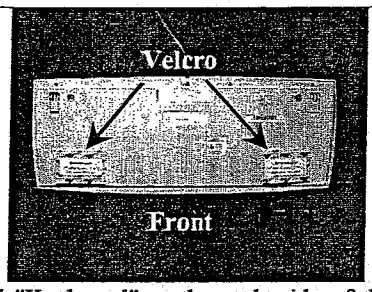


Turn over the template (so the lettering is face down onto the cart), and repeat the process on the left side of the cart.

BUILDING CARTS FOR KOTZEBUE

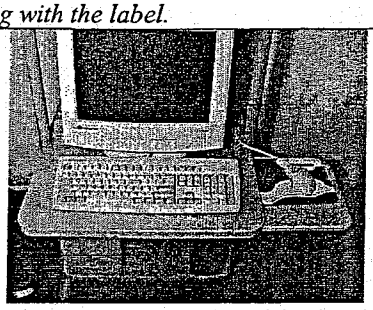
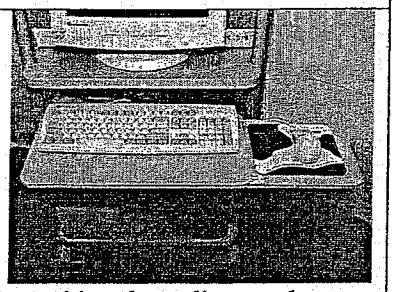
STEP #8: Install the keyboard, mouse and microphone

30" CLINIC CART	24" CLINIC CART	24" HOSPITAL CART



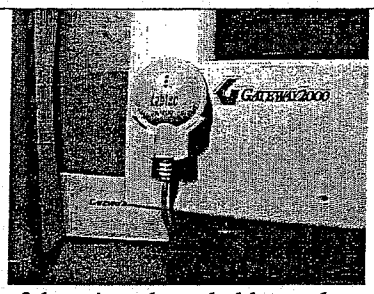
Stick the two Velcro pieces labeled "Keyboard" to the underside of the keyboard, positioning the pieces near the front of the keyboard and over the existing rubber pads. Shown above is the underside of the keyboard.

NOTE: Attach the side of the Velcro that is not labeled to the equipment by removing the paper backing. Do not yet remove the paper backing with the label.

Without removing the paper backing, position the keyboard in the right position depending on the cart: either towards the rear of the keyboard caddy (24" Hospital cart) or near the edge of the monitor's swivel base (24" and 30" Clinic carts). Make sure the keyboard lies parallel to the front edge. Then remove the paper backing with the label, and very carefully place the keyboard into position. The adhesive is non-removable, so only lower the keyboard onto the cart once the position is correct. Position the mouse pad and place the mouse on the pad.

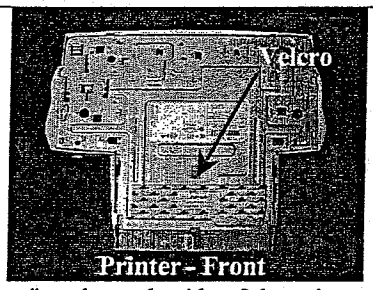
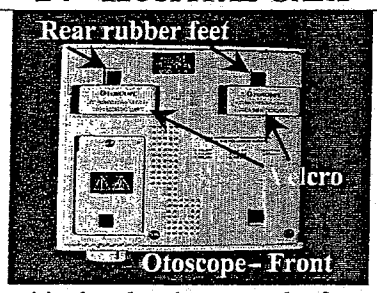
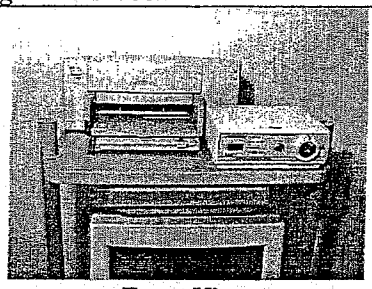
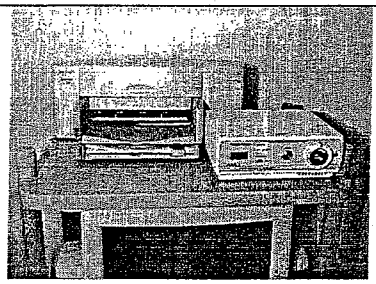
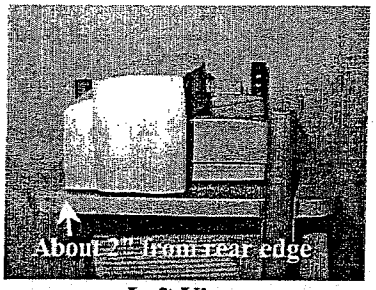
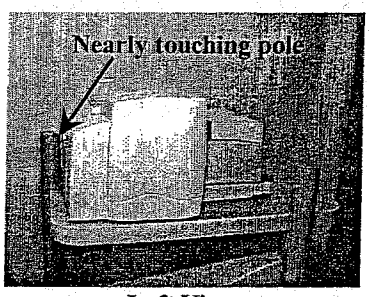
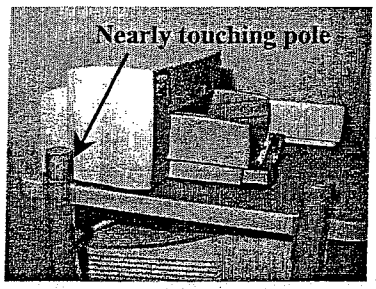
NOTE: Always position the equipment in the correct location before removing the paper backing. Once you are sure of the location, remove the paper backing with the label and press the equipment into place. Be careful - the adhesive sticks very firmly to the cart, with no chance for re-positioning the equipment. Then remove the equipment, and press down hard on the Velcro on both the cart and on the equipment to make sure the adhesive is stuck. Replace the equipment and make sure it remains securely positioned and does not move.



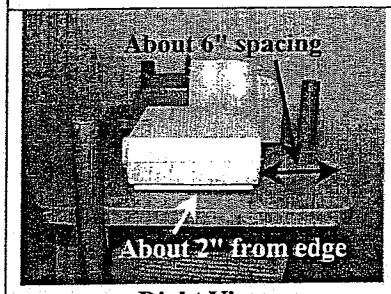
Peel the paper backing off the back of the microphone holder, and attach the holder to the lower left-hand corner of the monitor.

BUILDING CARTS FOR KOTZEBUE

STEP #9: Install the printer and otoscope

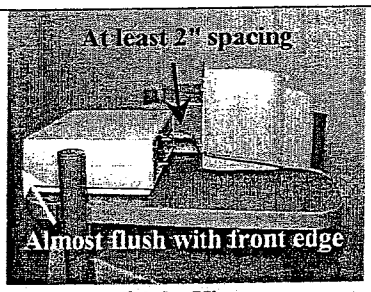
30" CLINIC CART	24" CLINIC CART	24" HOSPITAL CART
		
Stick the Velcro piece labeled "Printer" to the underside of the printer, positioning the piece near the front of the printer over the raised metal surface. Stick both the thin Velcro pieces labeled "Otoscope" to the underside of the otoscope, positioning the pieces near the rear of the otoscope but it front of the rear rubber feet (essentially center a Velcro piece in front of each rear rubber foot). Shown above is the underside of the printer (center) and otoscope (right). *NOTE: Attach the side of the Velcro that is not labeled to the equipment by removing the paper backing. Do not yet remove the paper backing with the label.*		
 Front View Without removing the paper backing, position the printer and otoscope on the upper shelf.	 **Front View** Without removing the paper backing, position the printer and otoscope on the upper shelf.	 **Front View** Without removing the paper backing, position the printer and otoscope on the upper shelf.
 **Left View** Position the printer snug against the left edge of the shelf, and about 2.5" from the rear edge.	 **Left View** Position the printer snug against the left edge of the shelf, and very close to the rear pole.	 **Left View** Position the printer very close to the left rear pole.
(See next page for more)	*(See next page for more)*	*(See next page for more)*

STEP #9: Install the printer and otoscope (continued)



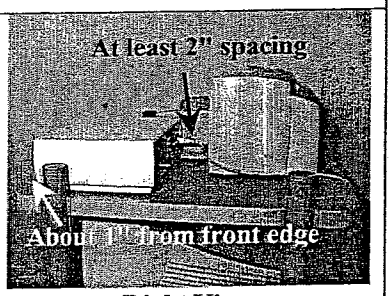
Right View

Position the otoscope about 2" from the right edge of the shelf, and about 6" from the rear edge.



Right View

Allow at least 2" between the printer and the rear of the otoscope for attaching cables. The otoscope should be almost flush with the front edge of the upper shelf.

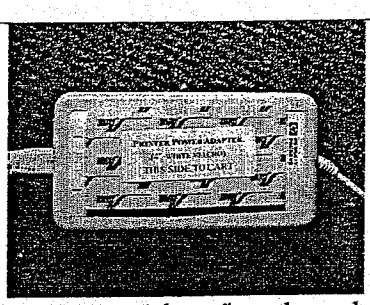


Right View

Allow at least 2" between the printer and the rear of the otoscope for attaching cables. The otoscope should be about 1" back from the front edge of the upper shelf.

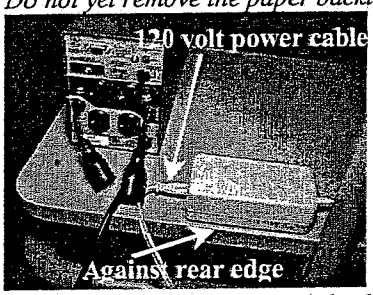
Then remove the paper backing with the label, and very carefully place the printer and otoscope into position. The adhesive is non-removable, so only lower the equipment onto the cart once the position is correct.

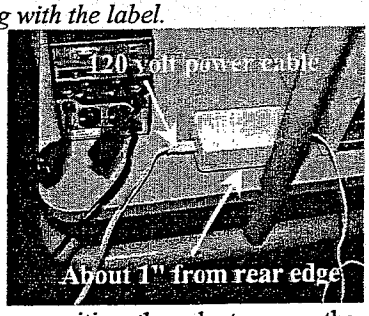
NOTE: Always position the equipment in the correct location before removing the paper backing. Once you are sure of the location, remove the paper backing with the label and press the equipment into place. Be careful - the adhesive sticks very firmly to the cart, with no chance for re-positioning the equipment. Then remove the equipment, and press down hard on the Velcro on both the cart and on the equipment to make sure the adhesive is stuck. Replace the equipment and make sure it remains securely positioned and does not move.

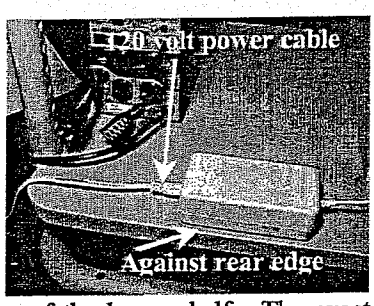


Stick the Velcro piece labeled "Printer Power Adapter" to the underside of the printer power adapter, positioning the piece across the rear side (the side with the HP label) of the adapter. Shown above is the underside of the printer power adapter.

NOTE: Attach the side of the Velcro that is not labeled to the equipment by removing the paper backing. Do not yet remove the paper backing with the label.



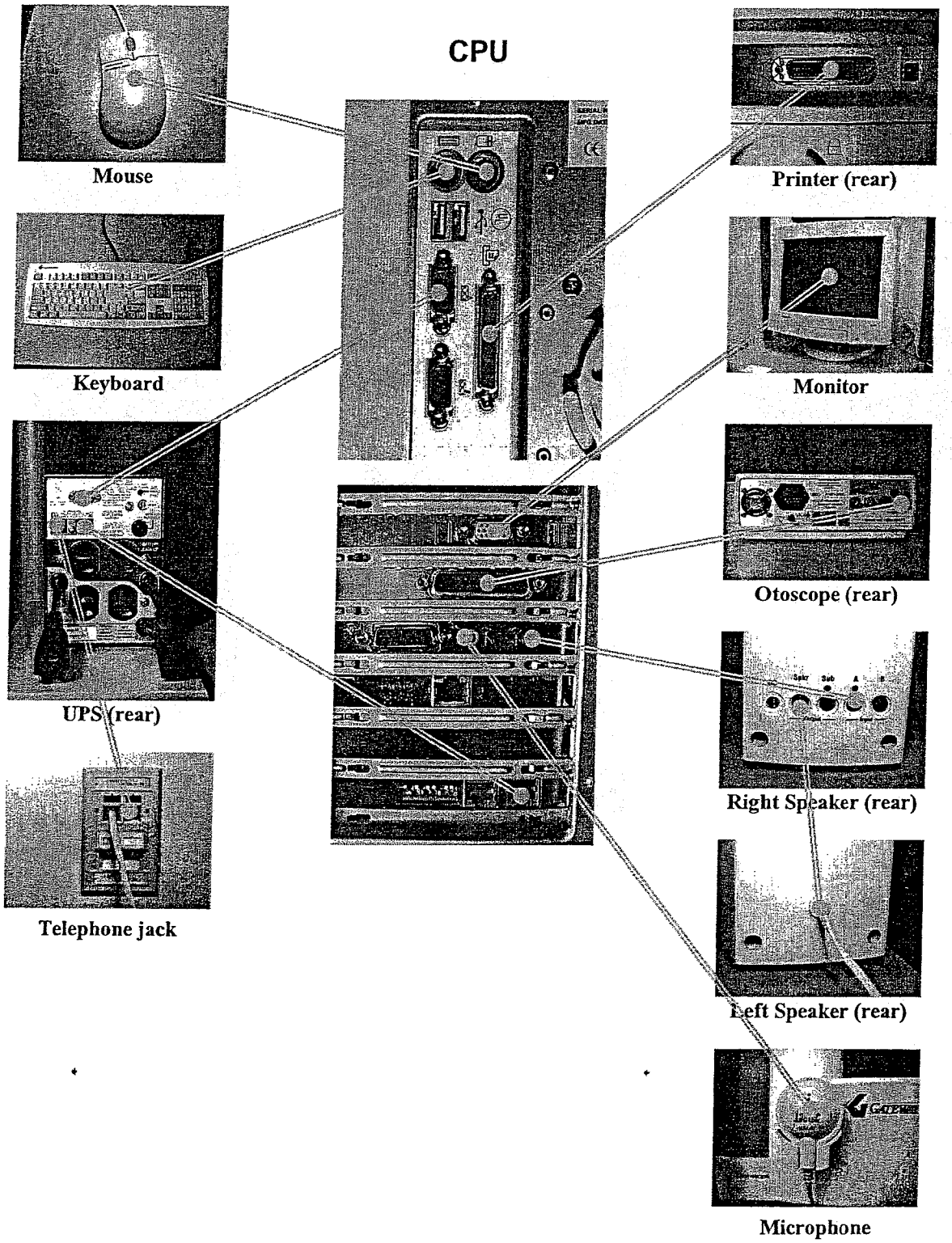




Without removing the paper backing, position the adapter near the rear of the lower shelf. The exact position is not crucial, but the adapter should not block access to any of the outlets on the battery backup. The adapter should be oriented so that it's power cord is nearest the battery backup. Then remove the paper backing with the label, and place the adapter into position. The adhesive is non-removable, so only lower the adapter onto the cart once the position is correct.

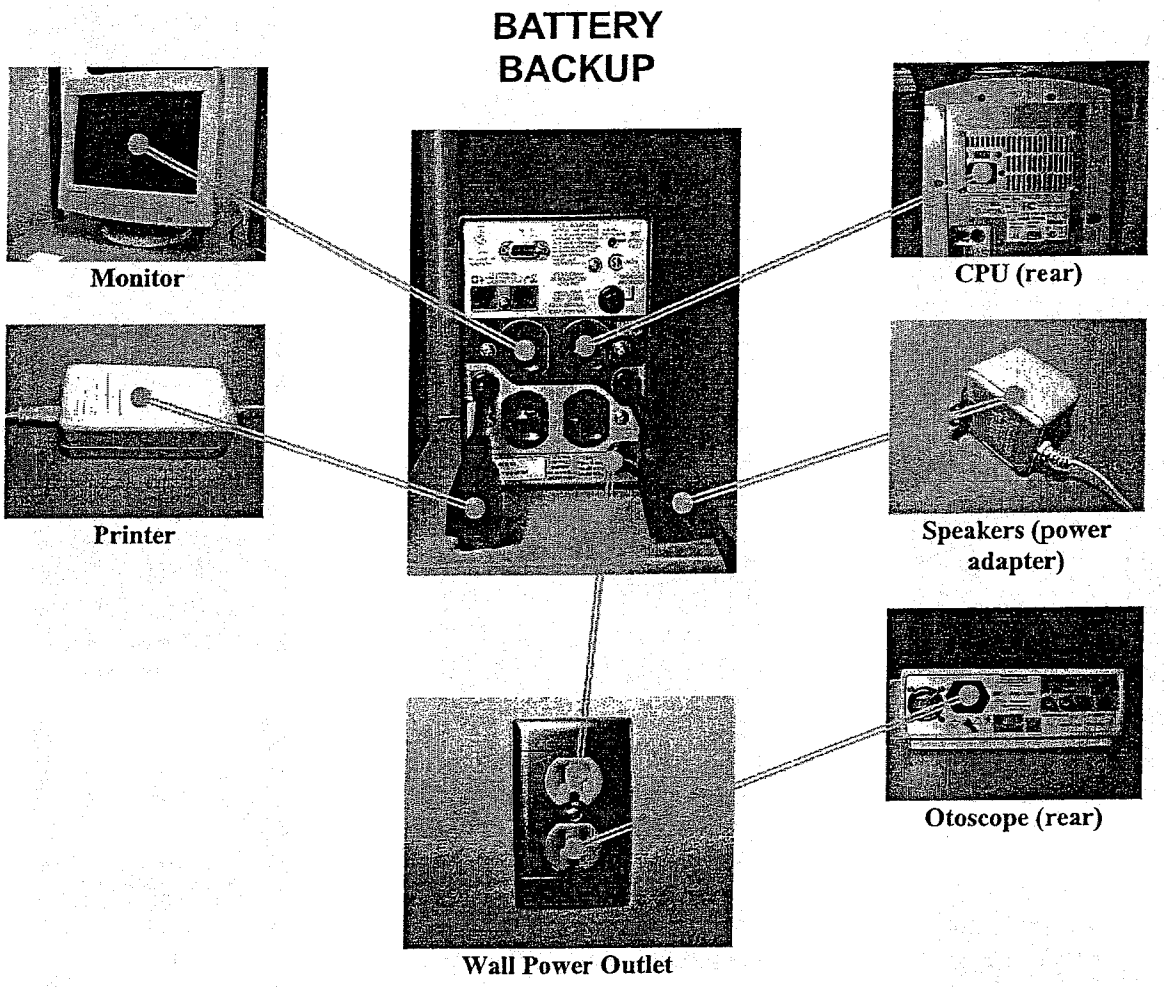
BUILDING CARTS FOR KOTZEBUE

STEP #10: Install wiring



BUILDING CARTS FOR KOTZEBUE

STEP #11: Install power cables



ATTP SCRIPT (REVISED)

In 19-96, the National Library of Medicine awarded the Applied Sciences Laboratory of the University of Alaska, Anchorage…funding for the Alaska Telemedicine Testbed Project.

This project was designed to demonstrate and evaluate the use of advanced telecommunications and information technology to improve the delivery of healthcare to the most remote parts of America's frontier… Alaska.

The sheer size of Alaska made this a difficult project for the N-L-M's advanced computing initiative. The remote nature of Alaska's village health clinics…as well as the poor telecommunications infrastructure…made this a challenging undertaking.

Without roads to drive to rural hospitals…Alaska community health aide practitioners…or CHAPS…are considered the primary care givers in villages ranging from seventy to eight hundred people. These CHAPS are chosen from the villages and receive modest training and support from the Alaska community health aide manual…single side bandwidth…and telephone…during a period each day called… radio medical traffic.

Grace Kirk
THE HEALTH AIDE PROGRAM, INTERNATIONALLY, IS A RARE PROGRAM. UNIQUE, IN THAT, IT ALLOWS A PERSON, WHO HAS VERY MINIMAL TRAINING AND EDUCATION, TO DO THINGS THAT ONLY A PHYSICIAN CAN, AND THERE ARE CERTAIN THINGS THAT RNS CAN'T DO, THAT WE DO… SUTERING, I'VS, DELIVER BABIES, PRESCRIBE MEDICATIONS, AND THE PROGRAM IS JUST SO IMPORTANT, THAT IF THERE ARE TOOLS THAT CAN HELP IT, WE NEED TO GO OUT THERE AND FIND THEM SO THAT WE CAN ENHANCE THIS PROGRAM TO MAKE IT WORK BETTER FOR THE PATIENT.

A specific goal of the Alaska Telemedicine Testbed Project was to develop…test…deploy…and evaluate a system for using telecommunications and information technology to deliver that healthcare "where and when it was needed."

In November, 19-96... all twelve of the regional Native Health Corporations received letters requesting interest in participating in the Alaska Telemedicine Testbed Project. Eleven proposals were submitted to the University of Alaska, Anchorage...by the January twelfth, 19-97 submission date. Proposals were judged according to a weighted average which considered the nature of the partnership between the Native Health Corporation and the University of Alaska, Anchorage.

Four Native Health Corporations were chosen to participate in the Phase Two of the National Library of Medicine Alaska Telemedicine Testbed Project. A detailed Request for Information...or R-F-I...was developed and approved during Phase One of the project. The R-F-I requested specific commitments from partners for developing a telemedicine team...willingness to provide staff infrastructure support...willingness to provide technical and logistical support...and willingness to participate in system development.

Memos of Agreement ...or M-O-A's...were negotiated between the University of Alaska, Anchorage...the project subcontractor, the Alaska Native Health Board...and the participating Native Health Corporations. These M-O-A's...specified responsibilities for all participating partners...contributions to the project...named project personnel...and established a timeline for system baseline data collection...system development...system requirements...data collection...and data analysis.

ıuck Akers
HAT I DID IN THE EARLY DAYS, WAS HELP DR. PEARCE AND HIS
'AFF CONNECT WITH THE RURAL ORGANIZATION AND FOR HIM
ND HIS TEAM TO UNDERSTAND THAT WE WERE GONNA BE
ARTICIPATING IN A SOMEWHAT POLITICALLY CHARGED ARENA
ND THAT FOLKS IN RURAL COUNTRY ARE NOT USED TO RESEARCH
IAT THEY PARTICIPATE IN. THEY'RE USED TO PEOPLE RESEARCHING
IEM. AND SO, MY GOAL, WAS TO MAKE SURE THAT OUR RURAL FOLKS
ARTICIPATED IN THE RESEARCH, UNDERSTOOD THE VALUE, AND IN
IE END, EMBRACED IT AND I THINK TO THAT END, THAT WAS THE
ITIAL EFFORT THAT I WAS BRINGING INTO THIS PROCESS.

The four Native Health Corporations were chosen to participate in the Phase two of the N-L-M project were.... the Maniilaq Health Corporation... headquartered in Kotzebue, Alaska...is the health corporation of the NANA Corporation. ...The Norton Sound Health Corporation...headquartered in Nome, Alaska, and is the health corporation for the Bering Sea Corporation. The Bristol Bay Are Health Corporation, headquartered in Dillingham, Alaska...is the health corporation for the Bristol Bay Native Corporation... And the Yukon-Kuskokwim Health Corporation...headquartered in Bethel, Alaska...is the health corporation for the Calista Corporation. The Kodiak Area Native Association was chosen as an alternative. In Phase Three of the project, approved in 2000...seven private sector sites serving Native and non-native populations were chosen to participate in the project. These sites were directed "hubb-ed" for healthcare services from Anchorage. These seven private sector sites brought the total of participating sites to thirty-three rural sites...four rural medical hubs...and two participating tertiary centers in Anchorage...the Alaska Native Medical Center....and Providence Medical Center.

Although the four participating Native Health Corporations were all located in western Alaska...geography and topography of Alaska ensured that the N-L-M project would be delivering healthcare services using advanced telecommunications services. Participating villages were hundreds of miles from Anchorage...without road access...and in a telecommunications environment dominated by a satellite backbone that delivered nine hundred baud average throughput in 1997...and increased to nineteen-hundred baud in 2000.

Because of the geography and topography of Alaska...medical transportation patterns are based on a village to regional hub....and a regional hub to Anchorage model. Patient movement is a dangerous and expensive proposition...even in the sunny summer months. An average flight from a village to a regional hub...which might be 75 air miles and take 30 minutes...is in a six-seat airplane on a regular schedule. These flights average $300. An average flight from the regional hub to Anchorage...which might be 600 miles and take 90 minutes...is in a commercial jet...on a regular schedule. These flights average $700. Emergency medical transportation from the village to the medical hub and the medical hub to Anchorage...can cost up to $25,000.

Preliminary data collection regarding 19-96 air transports from frontier Alaska to Anchorage...revealed that there were five primary areas for clinical air transportation...emergency medicine...O-B-G-Y-N...and dentistry...were judged to be impractical test cases. Ortho-LAIR-in-gology... ear, nose, and throat... and dermatology...were all judged to be good candidates for the study. E-N-T was selected as the primary case study because of the severity of ottis media...and because E-N-T 19-96 baseline numbers were not biased for age or gender. This data suggested that this clinic alone could justify that the engineering of transportation dollars could justify system implementation and sustainability of the basic project after the conclusion of the project.

Other project research goals were to discover the average length of stay by health care professionals in frontier Alaska...a benefits study to determine potential benefits in a state that relies on aircraft transportation...and a cost study designed to discover the average cost per transaction for each tele-health encounter.

Each participating region must be understood as a large and dynamic system on a scale difficult to imagine from a non-Alaskan perspective. Lack of advanced telecommunications services...lack of roads...and distant and low population density were challenges the project had to overcome.

For instance...according to the Alaska Department of Community and Regional Affairs...the Maniilaq Health Corporation provides healthcare to people living in an area of more than 41,000 square miles...the size of Tennessee. But while Tennessee is criss-crossed with highways and roads...and having a 2000 census population of nearly five-point-seven million people...the Maniilaq Health Corporation is responsible for delivering healthcare to a region that has ten villages...plus, Point Hope...which is administratively part of the Arctic Slope Regional Corporation. Maniilaq provides healthcare to seventy-six hundred people...with no road connections to the outlying villages.

The Norton Sound Corporation covers a geography of twenty-three thousand square miles...roughly the size of West Virginia...with a population of one-point-eight million people. With six of fifteen participating villages in the project...and no roads to use for health care delivery...there are nine thousand U-S citizens with health care needs met by the Norton Sound Health Corporation.

The Yukon-Kuskokwim Health Corporation covers more than 76-thousand square miles...an area the size of South Dakota. But...while, the rural state of South Dakota has a population of 754,844...with roads leading to county hospitals...and highways leading to tertiary health centers in Pierre and Souix City...Bethel is the healthcare hub for a region of 20-thousand people.

The Bristol Bay Area Health Corporation covers an area of more than 45-thousand square miles...the size of Pennsylvania. Whereas, Pennsylvania has a population of twelve-point-two million...B-B-A-H-C delivers healthcare to eight thousand...three hundred citizens in this rural region.

In Phase three of the project...seven private sector healthcare facilities were chosen to participate using a R-F-I process consistent with the goals of the project. Following the roads and railbelts radiating from Anchorage...this region is roughly 34-thousand square miles...the size of Maine with its population of one million...two hundred, seventy-four thousand...nine hundred, twenty-three people. Discounting the population of Anchorage...this catchment area has a population of 19-thousand in designated medically underserved areas.

From 19-96 to 2002...the participating health organizations in the National Library of Medicine, Alaska Telemedicine Testbed Project...were:

The Maniilaq Health Corporation...
Kotzebue...the medical hub of the Northwest Area Regional Corporation. It has a population of 3, 082.
Ambler...138 air miles from Kotzebue...with a population of 309.
Buckland...75 air miles from Kotzebue...with a population of 406.
Deering...57 air miles from Kotzebue...with a population of 136.
Kiana...57 air miles from Kotzebue...with a population of 388.
Kivalina...80 air miles from Kotzebue...with a population of 377.
Kobuk...128 air miles from Kotzebue...with a population of 109.
Noatak...55 air miles from Kotzebue...with a population of 428.
Noorvik....45 air miles from Kotzebue...with a population of 634.
Selewik...70 air miles from Kotzebue...with a population of 772.
Shungnak...150 air miles from Kotzebue...with a population of 256.
Point Hope...170 air miles from Kotzebue...with a population of 757.

The Norton Sound Health Corporation...
Nome...the medical hub of the Bering Straits Regional Corporation. It has a population of 3,505.
Elim...96 air miles from Nome...with a population of 313.
Gambel...200 air miles from Nome...with a population of 649.
Savoonga...164 air miles from Nome...with a population of 643.
Saint Michael...125 air miles from Nome...with a population of 368.
Shishmaref...126 air miles from Nome...with a population of 562.
Stebbins...120 air miles from Nome...with a population of 574.

The Yukon-Kuskokwim Health Corporation...
Bethel...the medical hub of the Calista Corporation. It has a population of 5,471.
Chevak...146 air miles from Bethel...with a population of 765.
Hooper Bay...160 air miles from Bethel...with a population of 1,014.
Kotlik...152 air miles from Bethel...with a population of 591.
Marshall...76 air miles from Bethel...with a population of 349.
Saint Mary's...99 air miles from Bethel...with a population of 500.

The Bristol Bay Area Native Health Corporation...
Dillingham...the medical hub of the Bristol Bay Native Corporation. It has a population of 2,466.
Goodnews Bay...110 air miles from Dillingham...with a population of 230.
Koliganek...65 air miles from Dillingham...with a population of 182.
Manokotak...20 air miles from Dillingham...with a population of 399.
Perryville...500 air miles from Anchorage...with a population of 107.
Point Heiden...424 air miles from Anchorage...with al population of 119.

The Private Sector...serving Native and non-Native populations...
Anchorage...the medical hub of Alaska...with four tertiary medical centers and a population of 260, 283.
Girdwood...40 road miles from Anchorage...with a population of 1,997.
Homer...210 road miles from Anchorage....with a population of 3,946.
Seward...110 road miles from Anchorage...with a population of 2,830.
Talkeetna...80 road miles from Anchorage...with a population of 772.
Valdez....210 air miles from Anchorage....with a population of 4,036.
Wasilla...50 road miles from Anchorage...with a population of 5,469.

The Alaska Telemedicine Testbed Project was designed as an evaluation project to discover if telemedicine could be used in these thirty-three remote frontier Alaska native villages. The purpose of the project was to build and deploy a working telehealth system to demonstrate the concept...and to evaluate telehealth practices for patient and provider satisfaction in telemedicine....closing the digital divide on healthcare in frontier Alaska...using existing tools.

Denise Statz
FOR THE MOST PART, THE WAY THE SYSTEM WAS DESIGNED... IT WAS A CLICK, CLICK, CLICK WITH A MOUSE...IT WAS ONLY ADDING A TOOL...A BETTER TOOL...TO CARE THEY WERE ALREADY USING. EVERY HEALTH AIDE IS TAUGHT TO USE AN OTOSCOPE TO LOOK AT EARS...AND A BRIGHT LIGHT TO LOOK AT THROAT AND NOSE. AND ALL THEY WERE DOING WAS BEING HANDED A MUCH SUPERIOR PIECE OF EQUIPMENT.

The Alaska Telehealth workstation... was designed to work in remote village community health clinics. This is a demanding environment with little technical support...fragile electrical systems and no techonological infrastructure or technical support as backup.
The Alaska Telemedicine workstation was build around best of breed components. At the heart of the Alaska Telehealth Workstation was a communications computer...a digital otoscope...and a digital camera.

Training sessions...work sessions...and technical work group sessions were held with representatives of four native health coporations to plan for system development and implementation.

:nise Statz
E MADE VISITS TO THE REGIONS, MET WITH REPRESENTATIVES
:OM THE VILLAGES, INTRODUCED THE FORMS AND PROCESSES,
D A FILM, AND THAT WENT WITH THEM SO THEY COULD SHOW
IE INFORMATION WITH THEIR COWORKERS.

The Alaska Telehealth System was designed and developed as a secure client-server messaging system to move clinical decision support data from village clinic to regional hub…and from regional hub to Anchorage. This included patient notes, digital images…and other clinical decision support information that could be digitized. During the project…training and support materials were provided to all villages.

:nise Statz
HEN WE TRAVELED TO THE VILLAGES, WE TRAVELED FOR THREE
AYS, THE FIRST DAY, WE'D MEET WITH HEALTH AIDES, USUALLY
'ENT SOME TIME TALKING ABOUT WHAT THEIR CONCERNS WOULD
:, HOPES WERE, SHOW THEM THE SYSTEM, JUST TO KIND OF GET
:ED TO THE SYSTEM. WE'D SPEND A WHOLE DAY, THE 3RD DAY,
WOULD JUST BE US OBSERVING THEM USING THE EQUIPMENT.

sie Pelowook
DIDN'T TAKE LONG FOR ME TO LEARN-FOR ANYONE TO LEARN-
WAS QUITE SIMPLE…1, 2, 3 AND YOU GOT IT AND WE ALL USED IT.

A-T-S v. 5 was a working clinical decision support system that was not implemented during the project because of the "politics" of healthcare in Alaska.

Because of the partnership status of participating healthcare organizations, a critical decision was made to use a software product called "medvision" based on Microsoft Exchange. While keeping the client-server model, this system had a one-year development overrun and, while able to demonstrate system use during the project, proved to be a poor system for further development and deployment.

During Phase III of the Alaska Telemedicine Testbed Project…A-T-S v. 6 was successfully used for delivering digital images and clinical information from private clinics serving native and non-native populations to tertiary facilities in Anchorage.

Building upon an evaluation model that was designed to measure patient and provider satisfaction…before and after the introduction of telemedicine in rural Alaska), as well as costs and benefits of telemedicine in rural Alaska, the Alaska Telemedicine Testbed Project was an innovative attempt to prove that telemedicine could work in a sustainable narrow bandwidth environment.

A comprehensive length of stay study revealed that high turnover of physicians…nurses…nurse practitioners…and community health aides. It was discovered that the average length of stay of healthcare professionals in frontier Alaska, depends on the level of professional status.

A principle satisfaction study based on over 10-thousand clinical cases…revealed that both patients and providers believed that the use of telemedicine for E-N-T and dermatology provided better medical care than previous available.

Agnes Bernhardt
WE ALSO ENCOURAGED THE PATIENT TO GO THROUGH THE PROCESS OF GETTING GOOD PICTURES. I THINK THEY WERE MORE EXCITED THAN WE WERE-THEY KNEW THAT ONCE THE PICTURE WAS TAKEN-IT'D BE SENT DOWN TO THE DR…I THINK A LOT OF PATIENTS WERE HAPPY TO SEE THAT.

Amy Carter
ONE OF OUR EARLY CASES, I WAS WORKING AT NOORVIK, AND WE HAD PATIENT THAT CAME IN AND SHE HAD ALLERGIC REACTION TO SOMETHING-WE WROTE IT OUT OF PF AND FAXED IT IN. AND WE WERE WORRIED ABOUT HER…SHE WAS RED, RED. DR. ASKED AND SHE SAID, 'CAN YOU SEND A PICTURE?' OK-JUST OPENING UP AND JUST LISTENING AND SHE'S ASKING ME WHAT DR. IS SAYING OR DOING. AND I'M LISTENING AND THE DR. SAID 'HOLY COW!' AND SHE SAID THE COW IS HOLY, AND OUR PATIENT GOT SENT DOWN.

Elsie Pelowook
BROTHER HAD A LARGE OPEN WOUND ON HIS THIGH, DEEP INTO MUSCLE…I TOOK IMAGES OF HIM, AND THE DR. DETERMINED MEDIVAC TO GO STRAIGHT FROM HERE TO ANCHORAGE… IT REALLY HELPED, ONCE AGAIN…TAKING PICTURES AND THE DR. BEING THERE TO OPEN THEM UP AND SEE THEM.

A principle benefits study suggested that the perceived benefit to the community health aide by the patient...was twenty-five dollars per encounter . The perceived benefit suggested that as a provisioned service, healthcare distribution in frontier Alaska, reduces the cost of the visit from fifty-four dollars to twenty-nine dollars.

The cost per transaction evaluation of the Alaska Telemedicine testbed project revealed that the overall cost per transaction for the entire project was one hundred dollars...But,...in villages, where the system was used extensively, this cost is as low as ten dollars per transaction.

One unforeseen research feature of the project was mitigation of the indiscriminate use of antibiotics after the introduction of the Alaska telemedicine workstation. The principle antibiotics study revealed that the use of the workstations...reduced the use of antibiotics by fifty percent.

ınise Statz
E ACTUALLY WERE IMPRESSED BY THE FACT THAT PEOPLE,
)ME OF THE HEALTH AIDES WOULD TELL US THAT HISTORICALLY,
IEY WOULD ASK A PARENT TO BRING A CHILD BACK AFTER THE
)URSE OF ANTIBIOTICS, BUT THEY WOULDN'T DO THAT, WITH
IIS SYSTEM, SINCE THEY WOULD SEE THIS EAR DRUM AND THEY
NEW WHAT THEY WERE TREATING, THEY WERE ANXIOUS TO SEE
IAT IF TRULY RESOLVED AND SO THEY'D BRING THEIR KIDS BACK
. THE OTHER THING THAT THE HEALTH AIDES HAVE TOLD ME, THAT
IEY FELT LIKE PARENTS WERE COMPLETELY USING THE ANTIBIOTICS
)R THE FULL COURSE, BECAUSE THEY COULD BETTER SEE WHAT WAS
AUSING THEIR CHILD PAIN.

Project partners believe that the Alaska telemedicine testbed project was a success. Following the successful A-T-S-one and A-T-S six...NASA funded projects of the 19-70's...this project proved that telehealth services could be delivered in the most demanding climatic and telecommunications environments in the world.

ıuck Akers
NCE THEY REALIZED THAT IT WAS HELPING THEM DO THEIR JOB
:TTER, THEN THEY WERE MUCH MORE CONFIDENT IN THE FACT
IAT THEY WERE, ONCE AGAIN, DOING GOOD WORK FOR THEIR
OPLE.

ise Statz
VILLAGES ALL PROVED THAT THEY COULD SEND QUALITY IMAGES TAKEN BY HEALTH AIDES, BOTH USING AN OTOSCOPE AND USING A DIGITAL CAMERA. SOME REGIONS PROVED THAT THEY COULD INTERGRATE THOSE TOOLS INTO GENERAL CARE; SOME PROVED THAT THEY COULDN'T. I WOULD JUST LIKE TO KNOW, OR SEE, THIS WHOLE THING TAKE ITS PROPER PLACE.

Agnes Bernhardt
I WAS PRETTY IMPRESSED AND AMAZED THAT YOU CAN GET A PICTURE OF THE EAR DRUM...PUT THAT OTOSCOPE IN THERE AND SEND THAT PICTURE TO THE DOCTOR. THAT WAS REALLY EXCITING, SOMEONE ELSE OTHER THAN ME, THE HEALTH AIDE CAN SEE IT. I THOUGHT THAT WAS PRETTY IMPRESSIVE.

The success of the Alaska Telemedicine Testbed Project can be measured in the number of clinical encounters recorded during the project. It can be measured in terms of the re-engineering of healthcare delivery to remote villages; in the implementation of "new tools" used by community health aides to improve the delivery of healthcare to America's most remote citizens, and in the voices of the community health aides of Alaska's remote villages.

Grace Kirk
I AM HAPPY WE'RE INVOLVED IN THIS-THAT WE'RE AS A REGION-THAT WE'RE COMFORTABLE ENOUGH, WE'RE NOT AFRAID TO STEP FORWARD INTO THE FUTURE, BUT WE ALSO HAVE TO HANG ONTO SOMETHING THAT'S VERY UNIQUE, AND IMPORTANT FROM THE PAST THAT WILL MAKE US THAT MUCH MORE BETTER-THAT MUCH MORE SKILLED.

Elsie Pelowook
IT WAS SUCCESFFUL-VERY-IT'S HELPED A LOT OF PEOPLE, AND IT'S HELPED US AND IT HELPED NOME, THE HOSPITAL. IT GAVE BETTER, EFFECTIVE CARE TO THE PEOPLE WE SERVE HERE.

Kerry Dorius
IT BENEFITS THE REGULAR PEOPLE WHO LIVE HERE IN THE COMMUNITY, AND IT BENEFITS THE VISITORS TO THE AREA, BECAUSE IT ALLOWS THEM TO GET MORE THAN JUST PRIMARY CARE, IT ALLOWS ME TO SHOW WHATEVER THEIR PROBLEM IS TO A SPECIALIST AND THEY CAN GET IMMEDIATE OR QUICK ACCESS TO A SPECIALIST'S OPINION.

ɛnise Statz
)OKING BACK ON IT, I HAVE TO SAY, A PERSON HAS FEW
?PORTUNITIES TO BE INVESTED IN SOMETHING TO THE LEVEL THAT
VAS INVESTED IN THIS PROJECT. IT WAS LIFE-CHANGING FOR ME.

Project partners believe that the commitment of the Alaska village community health aides to this new tool…was the success of this project.

ıuck Akers
IIS PROJECT, I THINK FOR ME, AS A RURAL ALASKAN, WAS THE FACT
IAT THE HA IN THE COMMUNITIES WERE VERY ADAPTABLE TO
ıKING ON THIS TECHNOLOGY. THE FACT THAT ON AN OUTSIDE VIEW
IIS IS TECHNOLOGY, IT'S GOING TO RURAL ALASKA NATIVE COMMUNITIES…
HAT DO FOLKS KNOW ABOUT IT? AND THE SUCCESSFULNESS WITH THIS,
ONCE THE COMMUNITIES UNDER THAT, WERE AWARE THAT THIS WAS A TOOL, THEY USED
AND THEY USED IT WELL.

gene Smith
)ON'T EVEN THINK WE'RE CLOSE TO GOING AS FAR AS WE CAN
) . THE FACT IS, WHEN YOU GET OUT IN THE VILLAGES IN THE
ONT LINE, THOSE CHPS…YOU HAVE TO BOW DOWN…THEY'RE THE
'ES AND EARS…THEY'RE THE DRS. OF THE COMMUNITY. SO WHETHER
'S A TRAUMA TYPE SITUATION THAT HAPPENS, AND IT GOES TO THE
INIC, IF THERE'S ENOUGH TOOLS TO MAKE NOT ONLY THE CHP'S LIFE
SIER, BUT THE PATIENT QUALITY OF LIFE, A LITTLE MORE EFFICIENT,
YTHING WILL MAKE OUR LIFE EASIER.

The Alaska Telemedicine Testbed Project was designed as a demonstration and evaluation project… It was based on a simple though profound research question… can telecommunications and information technologies be used to improve the delivery of healthcare in rural Alaska?

Despite a demanding technical and political environment…development and software delays…the Alaska Telemedicine Testbed Project accomplished all major objectives defined by this project.

As a result of the success of the Alaska Telemedicine Testbed Project, funded by the National Library of Medicine, people living in Alaska's isolated villages have improved access to modern healthcare. Moreso, as a direct result of the success of the N-L-M project, Alaska's congressional delegation secured funding from Indian Health Services, the Department of Defense, the Department of Transportation, and the Department of Veterans' Affairs…to expand the reach of the Alaska Telemedicine Testbed Project from 33 villages to all 235 villages in Alaska.

Though the efforts of the National Library of Medicine…the Applied Science Laboratory of the University of Alaska, Anchorage…the Alaska Native Health Board… and the participating Native Health Corporations…the Alaska Telemedicine Testbed Project will elave a legacy of success for the people of Alaska.

CREDIT ROLL WITH MUSIC

7.27

CONFIGURATION OF GATEWAY COMPUTERS FOR KOTZEBUE

Windows NT Operating System

Version	v4.0 with Service Pack 3
Administrator Account name	ATTPAdmin
Administrator Account password	ATTPpassword
Computer Name	ATTP_*village*
Folder Information	C:\I386 contains all the files required to make changes to the operating system. This is a duplicate of D:\I386 from the Windows NT Workstation CDROM.

BIOS Setup

Supervisor Password	ATTP
COM A	Default to COM1
COM B	Disabled
Printer Port	Default to LPT1
First Boot Device	Hard Drive
Second Boot Device	Removable Devices
Third Boot Device	ATAPI CD-Rom Drive
Fourth Boot Device	Network Boot

Hardware Configuration

AGP Slot	Matrox Millenium II with 4 Meg RAM
PCI #1	FlashBus MV Pro JP4 and JP6 are only jumpers connected
PCI #2	Ensoniq sound card *CDROM audio cable to connector nearest back of card*
PCI #3	3COM 3C905-TX Network Interface Card
PCI #4 / ISA #1	*empty*
ISA #2	US Robotics 56K V.Everything Courier modem *Dip headers set for COM2* *(IRQ3, J4A - Out, J4B - In, J4C - In)* *Rear switches* *(only 3,5,8 are "On")*

7.28

PREPARATION OF GATEWAY COMPUTERS FOR KOTZEBUE

Remove hard disk assembly

1. Remove main side over (2 finger screws at back)
2. Remove other side cover (2 screws at back)
3. Remove front cover (press in on large clips near top of computer, tilt forward, then lift up)
4. Remove hard disk assembly (four screws at front, one screw for bracket attached to 5.25" bays above, and one screw at back of computer holding the long bracket that extends from the assembly to the back of the case)
5. Disconnect controller cable and power supply cables.

Drill holes in base of CPU (computer)

1. Remove all cards within computer
2. Turn case upside town
3. Align template
4. Mark drill holes
5. Tap nail at drilling positions
6. Drill holes
7. Align "new" template (to be used on cart) and punch in actual drill holes
8. Lay the "new" template inside the case on the bottom - for later use

Drop the 3.5" floppy drive and CDROM drive

1. Remove all cables on the fdd (floppy disk drive)
2. Remove the fdd from the CPU (4 screws - 2 on each side)
3. Remove the thin-metal cover on the lowest 3.5" bay
4. Install the fdd in the lowest 3.5" bay
5. Remove all cables to the CDROM drive
6. Remove the CDROM drive from the CPU (4 screws - 2 on each side)
7. Remove the thin-metal cover on the second lowest 5.25" bay
8. Install the CDROM drive in the second lowest 5.25" bay
9. Replace the thin-metal covers on the upper 3.5" and 5.25" bay from where the fdd and CDROM drive were removed
10. Replace the cables on the fdd (controller cable and power cable)
11. Replace the cables on the CDROM drive (controller cable, audio cable, power cable)
12. Remove the bay covers on the front panel of the CPU (covering the bays now having the fdd and CDROM drive) and move them to the bays that previously had the fdd and CDROM drive.

Copy GOLD hdd to another hdd

(Assuming the Gold hard disk is the master boot disk in a computer, and it is desired to copy this to a disk that has been removed from another computer)

1. Install GOLD hdd as Master in a computer with all cards installed
2. Install a second hdd as a Master on the secondary controller cable (disconnect the CDROM and connect that cable to the second hdd)
3. Boot, hit F1 and set boot options to removable media before all other devices
4. Boot from Drive Image disk 1 of 2 using Windows 95 disk.
5. Run FDISK - remove all partitions on second hdd
6. Boot from Drive Image disk 1 of 2 using Windows NT disk.
7. Insert Disk 2 of 2 and type "A:\PQDI"
8. Follow instructions for Disk to Disk copy - accepting defaults except:
   Resize Options: Select "Leave Remaining free space"
   Advanced options (on 2nd and later copies), only the "Skip Bad Sector Check" should be marked.
   First time through - only the "Check for File System Errors" should be checked.

PREPARATION OF GATEWAY COMPUTERS FOR KOTZEBUE

Install cards and hard disk drive assembly

1. Replace the hard disk assembly in the computer.
2. Install these cards:
    - **AGP slot**: Matrox Millenium II graphics card
        Shift connector and wall bracket up, so card seats deeply
        Flatten out top of wall bracket where screw goes
    - **PCI #1** (nearest power supply): FlashBus MV Pro
        Record serial number
        JP4 and JP6 are only jumpers connected
    - **PCI #2**: Ensoniq PCI sound card
        Connect CD Audio cable to connecter nearest back of computer
    - **PCI #3**: 3COM 3C905-TX Network Interface Card
        Record the serial number and EA number
    - **PCI #4 / ISA #1**: Empty
    - **ISA #2**: US Robotics 56K Internal V.Everything Courier modem
        Record the serial number
        Dip headers set for COM2:
            IRQ 3
            J4A - Out, J4B - In, J4C - In
        Dip switches 3,5 and 8 are only switches "On"
3. Place the drill-hole template inside the computer

Connect system for testing

1. Connect the following equipment for testing
    Power Supply
    Keyboard
    Mouse
    UPS (to COM A)
    Printer
    Monitor
    FlashCard cable to video otoscope
    Speakers
    Microphone
    Modem cable
2. On BOOTUP - hit F1 to enter BIOS SETUP (probably get an error about COM-B error - hit F1 again to enter BIOS Setup) and do this:
    Main Menu - System Time: set
    Main Menu - System Date: set
    Advanced Menu - Peripheral Configuration - set Serial Port B: DISABLED
    Security Menu - Set Supervisor Password - set as "ATTP"
    Boot Menu -
        First Boot Device: Hard Drive
        Second Boot Device: Removable Devices
        Third Boot Device: ATAPI CD-Rom Drive
        Fourth Boot Device: Network Boot
3. Login as "ATTPAdmin" with password "ATTPpassword"
4. Run "New SID" software:
    Change workstation name to "ATTP_*village*"
    Generate new SIDs for workstation
    Reboot system
5. Check all hardware
6. Change number for dialing UAA server by going to "Setup" from the main login screen and changing dialup number (at bottom of screen) to 1,907-562-9472 (do not use the "9" prefix).

PREPARATION OF GATEWAY COMPUTERS FOR KOTZEBUE

7. On KOTZEBUE computers with MedRx equipment - change the FlashBus software to use Composite input and save settings.

PREPARATION OF GOLD HARD DISK FOR KOTZEBUE

Prepare to Install Windows NT in GOLD hdd

1. While connected to the network, place a second hdd in a computer, create an NTFS partition, and format it. Copy the necessary files from the server to this hdd (e.g. Service Packs, etc).
2. Power down, disconnect this hdd.

Install Windows NT

1. Modify Setup BIOS to boot first from the CDROM drive
2. Install a single hdd, to be formatted and made into the gold hdd
3. Remove all cards except for the Matrox Millenium II graphics card in the AGP slot
   Shift connector and wall bracket up, so card seats deeply
   Flatten out top of wall bracket where screw goes
4. Insert the Windows NT Workstation CDROM, and boot the computer
5. Create an NTFS partition
6. At prompt, enter:
   Name: User
   Organization: ATTP
7. At prompt, enter:
   Product ID: 02398-OEM-0030112-01651
   Computer Name: ATTP_KOTZEBUE
   Password: ATTPpassword
8. Select all Windows components
9. Do NOT connect this computer to a network at this time
10. Set time and zones, accept default VGA mode
11. System will reboot, check that you can logon as Administrator, then shutdown

Copy software, install some video drivers and upgrade to operating system

12. Attach second hdd that contains all the software upgrades and software for installation. Boot the system, unchecking the box that display the Welcome banner.
13. Make a directory on C: called "Installation", and copy all the software and patches from the D: to this directory. Set the View options to:
    Show all files
    Display the full path in the title bar
    Do NOT hide the extensions for known file types
14. Shutdown the system, remove the second hdd, and reboot.
15. Install Matrox drivers (custom):
    Disable launching MGA QuickDesk at Startup
    Click Close and restart the computer
    Do not change the video settings yet
16. Install the Windows NT Service Pack 3 - do not create an uninstall directory, reboot system
17. Change the video settings to:
    1024x768
    True color
    75 Hz refresh
    Black background
    Reboot
18. Make changes with User Manager:
    Change Administrator account name to ATTPAdmin
19. Make changes in "System" Control Panel
    Change "System Startup .. Show list" to 3 seconds
20. Change the Desktop:
    Delete "My Briefcase"
    Delete "Internet Explorer"
21. Change MGA Display Properties (right click on Desktop)

PREPARATION OF GOLD HARD DISK FOR KOTZEBUE

Change monitor type to "Plug and Play DDC monitor"

Install Remaining Cards and Add Drivers

1. Shutdown, install these cards:
   - PCI #1 (nearest power supply): FlashBus MV Pro
     - Record serial number
     - JP4 and JP6 are only jumpers connected
   - PCI #2: Ensoniq PCI sound card
     - Connect CD Audio cable to connecter nearest back of computer
   - PCI #3: 3COM 3C905-TX Network Interface Card
     - Record the serial number and EA number
   - PCI #4 / ISA #1 Empty
   - ISA #2: US Robotics 56K Internal V.Everything Courier modem
     - Record the serial number
     - Dip headers set for COM2:
       - IRQ 3
       - J4A - Out, J4B - In, J4C - In
     - Dip switches 3,5 and 8 are only switches "On"
   - Connect HP720C printer
   - Connect UPS to Com1
   - On BOOTUP - hit F1 BIOS and disable COM2 on motherboard
2. Reboot - logon as ATTPAdmin
3. Install FLASHBUS drivers:
   - Run C:\Installation\FlashBus\\v3.0\Setup
   - Accept all defaults
   - Reboot system
   - In the Multimedia Control Panel, Devices Tab, Other Multimedia Devices, FlashBus Video Properties, Settings ... change Bytes reserved to 0.
   - Edit C:\WINNT\FBG.INI, change lines to read:
     - OnScreen = 1
     - OffScreen = 0
   - Reboot
   - Run FBG32 - accept error at start
     - Setup Menu - Video - Change input to S-video
     - Tools menu - Configuration - Make sure "On Screen" is selected.
     - File menu - Save Settings
4. Install SOUNDS CARD drivers:
   - Control Panels - Multimedia - Devices - Add - Unlisted or Updated driver - Browse - C:\Installation\Gateway\WinNtDrv\Audio\ENQPCI\
   - Accept all defaults
5. Install MOUSE drivers:
   - Run Setup in C:\Installation\Gateway\WinNtDrv\Mouse\MS
   - Accept all defaults
   - Right click on Mouse icon in System Tray - Remove Icon from tray
6. Install MODEM drivers:
   - Control Panels - Modem - Add modem (Check the "Select from List" box)
   - Install standard driver for US Robotics Courier V.Everything Internal on COM2
     - Country: USA
     - Area code: 907
     - Set Maximum Speed: 115200
     - Advanced Setting - Extra Settings: E1
7. Install Network drivers:
   - Control Panels - Network - Accept option to install networking

Select both "Wired to Network" and "Remote access to the network"
Select driver located in C:\Installation\3Com
Accept all defauls (including TCP/IP as protocol)
Do not run 3COM diagnostics
Select NO DHCP server on network
TCP/IP Settings:

Reboot - expect errors during restart
Control Panels - Network -
Remove TCP/IP protocol
Remove all services except RMON
Reboot

8. Copy CDROM for Windows NT directory D:\I386 to C:\I386. Change all occurrences of D:\i386 in registry to c:\i386
9. Install HP720C software from CDROM (Autorun from CDROM)
   Accept all defaults
   Reboot system
10. Install APC UPS v5.1 software from c:\Installation directory
    Use Custom setup - accept all defaults
    Reboot system

Install Application Software and Modify Configuration

1. Install Word from CDROM: Office 97, Small Business Edition. At prompts, enter:
   Name: User
   Organization: ATTP
   Product ID: 02398-OEM-0030103-74126
   Custom installation - Select ALL options
2. Install Excel from CDROM: Office 97, Small Business Edition. At prompts, enter:
   Name: User
   Organization: ATTP
   Product ID: 02398-OEM-0030103-74126
   Custom installation - Select ALL options
3. Install Microsoft Service Pack 1 for Office 97 from c:\Installation directory, reboot
4. Install Internet Explorer v4.01 from C:\installation directory. At prompt, do Full Installation
5. Delete "Setup Internet Explorer v3.x" from Desktop (left over from Office)
6. Right click on 3COM system tray icon - select "Disable icon" to remove it.
7. Install Colorific Calibration software from CDROM: Matrox Millenium in \Color directory.
8. Right click on Colorific icon in System tray - Exit
9. Copy SysInternals folder from C:\Installation to C:\Program Files
10. Modify start menu:
    Remove standard Office97 generic shortcuts (Create New document etc)
    Open Start Menu All Users - move Word, Excel and PhotoEditor shortcut to Start Menu
    In Start Menu All Users, make shortcut to c:\program files\Sysinternals\newsid, and label is "New SID" and give it a different icon
11. Control Panel - FindFast - delete index.
12. Install Adobe Acrobat Reader v3.01 - use default settings
13. Install Adobe Acrobat Reader v3.01 explorer plugin- use default settings
14. Install First Class using the install program. Replace the C:\FCICWIN directory with the duplicate directory from Stewart's computer (found in c:\installation), change the login parameters to Guest (password guest). Make a shortcut to the file TCP.FC in the Settings directory, place it in the Start Menu in the First Class folder, and label it " Dial-up University of Alaska Anchorage". Use Edit - Properties to change the signature string to be appropriate for the testing phase.

PREPARATION OF GOLD HARD DISK FOR KOTZEBUE

15. Install WinZip (unregistered version), doing Custom installation, accepting all defaults except do not put shortcut on Desktop and open in Classic form.
16. Install NetMedic - do NOT put into Startup menu. Run and view the Modem parameters, which activates a 30 day grace period for advanced features.
17. Install McAfee v3.1.4, with Custom installation, and select System Account for boot scanning. Copy the latest DAT files to c:\Program Files\McAfee\VirusScanNT directory.
18. Open Start Menu - create folder called "Hardware Installation Tests". Do the following:
    Move the HP DeskJet 720C toolkit shortcut from the desktop into this folder
    Copy \Start Menu\Programs\3COM NIC Utilities\3nicdiag - rename as "3COM Diagnostics"
    Copy \Start Menu\Programs\Accessories\Multimedia\CD Player and Sound Recorder
    Copy \Start Menu\Programs\First Class Internet Client\Dial-up University of Alaska Anchorage
    Copy \Start Menu All Users\Programs\Colorific\Colorific for Windows
    Copy \Start Menu All Users\Programs\PowerChute Plus\ PowerChute Plus
    Copy \Start Menu All Users\Programs\FlashBus\FBG32 and rename as FlashBus
    Copy \Start Menu All Users\Programs\Ensoniq AudioPCI AudioMixer
19. Start Word, Excel, using the name "User" with initials "ATTP". Set default storage to be C:\M<y Documents (must create this directory and give everyone Full Control permissions).
20. If a problem occurs with the FlashBus card, open the Multimedia Control Panel, and add a device by going to the c:\flashbus\Nt directory, and set the memory requirements at 0
21. Ensoniq Mixer - set Mic Mute off, check Recording Balance - Mic option.
22. Delete INBOX from the desktop
23. Change sound scheme to Utopia

    Clean up before finishing
24. Clear event log
25. Wipe out Recycle Bin
26. Open C:\drive - and arrange all folders by name
27. Delete the contents of C:\temp folder
28. Remove Outlook Express shortcut on Desktop
29. Make shorcuts on the desktop for:
    "\Start Menu\hardware Installation tests" - rename as "Hardware Installation Tests"
    A:\ fdd - rename as "3 1/2" Floppy (A)"
    C:\ hdd - rename as "(C) drive
    D:\ CDROM - rename as "CD-ROM disc"
    Line up icons on desktop - arrange appropriately then select "Line up icons"
    Copy the shortcut to "Hardware Installation Tests" into \Start Menu\Programs\Startup

TESTING WORKSTATIONS FOR KOTZEBUE

Prepare to Test Workstations

1. Make sure all connections have been made on the back of all equipment
2. Plug the UPS into a power outlet
3. Plug the modem cable into a telephone jack

Windows NT

1. Turn on the power at the UPS
2. Turn on all the equipment
   CPU - if light is not on, turn on
   Monitor
   Speakers
   Printer
   Otoscope
3. At prompt, enter:
   Name: ATTPAdmin
   Password: ATTPpassword
4. Should see desktop with an open folder containing all the test software

Printer

1. Turn on the power at the UPS
2. Turn on all the equipment
   CPU - if light is not on, turn on
   Monitor
   Speakers
   Printer
   Otoscope
3. At prompt, enter:
   Name: ATTPAdmin
   Password: ATTPpassword
4. Should see desktop with an open folder containing all the test software

3COM Network Interface Card

1. Run the 3COM diagnostic software, ignoring the warning that you will be disconnected from the network, and go through all tests.

CD-ROM drive and Speakers (CD Player)

1. Insert a CDROM that has some sound component - play something.

3.5" floppy disk drive

1. Insert a 3.5" floppy disk - copy files from "C:\MY DOCUMENTS" to the floppy disk.

Microphone (Sound Recorder)

1. Run the "Sound Recorder" software, and attempt to record your voice.

FlashBus and Otoscope

1. Run the FlashBus software and maximize the window.
2. Wave your hand in front of the otoscope - you should see a fast moving image in the window.

TESTING WORKSTATIONS FOR KOTZEBUE

UPS (PowerChute Plus)

1. Run the PowerChute software. You should be able to see the characteristics of the UPS.

Modem and Connectivity (Dial-up Access to UAA)

1. Run the email software. Click the "LOGON" button
2. Start a new email message using the leftmost icon on the toolbar:
    - Address it to "Stewart Ferguson"
    - Type in the name of the village in the Subject
    - Attach a file by clicking on the "Attach" icon.
    - Select the first ZIP file (the smallest) by double clicking on it - time how long it takes to transmit that file to the server.
    - Attach a second file - using the next file in the list - and again time how long it takes to transmit it to the server.
    - Attach the third, fourth ... file until it is taking too long to transmit the files.
    - In the body of the email message, type in the transmit time for each file
    - Click the "Send" button to send the email
3. Quit the program, and log off

Burn-in Testing

1. Allow workstation to remain turned on for a long period (preferably overnight) while logged in as ATTPAdmin
2. Make sure the operating system responds, and repeat some quick tests (such as NIC, FlashBus)

A. Stewart Ferguson
Alaska Telemedicine Testbed Project

Inventory to Ship to Kotzebue (ordered by Box Name)

DESCRIPTION	Box Name	Quantity per Site	What Villages get Equipment	Who Pays for Equipment	QUANTITY (and who pays) FOR EACH LOCATION										
					Ambler NLM	Buckland KOTZ	Deering KOTZ	Kiana NLM	Kivalina KOTZ	Kobuk KOTZ	Noatak NLM	Noorvik NLM	Selawik NLM	Shungnak KOTZ	Kotzebue NLM
ANTHRO Cart	Cart - Box X of 6	1	ALL	NLM	1	1	1	1	1	1	1	1	1	1	1
Total for Box: Cart - Box X of 6															
APC Back-UPS Pro 650 PnP	Battery Backup	1	ALL	DEPENDS	1	1	1	1	1	1	1	1	1	1	1
Total for Box: Battery Backup					1	1	1	1	1	1	1	1	1	1	1
SONY Mavica FD7 or Olympus camera	Digital Camera	1	ALL	KOTZ	1	1	1	1	1	1	1	1	1	1	1
Total for Box: Digital Camera					1	1	1	1	1	1	1	1	1	1	1
GATEWAY Monitor	Monitor	1	ALL	DEPENDS	1	1	1	1	1	1	1	1	1	1	1
GATEWAY Monitor power cord	Monitor	1	ALL	DEPENDS	1	1	1	1	1	1	1	1	1	1	1
GATEWAY Monitor swivel base	Monitor	1	ALL	DEPENDS	1	1	1	1	1	1	1	1	1	1	1
GATEWAY Monitor manual	Monitor	1	ALL	DEPENDS	1	1	1	1	1	1	1	1	1	1	1
Total for Box: Monitor					4	4	4	4	4	4	4	4	4	4	4
WELCH ALLYN AMD-300s illumination platform	Otoscope	1	NLM	NLM	1			1			1	1	1		1
WELCH ALLYN camera with cable	Otoscope	1	NLM	NLM	1			1			1	1	1		1
WELCH ALLYN 45mm Coupler	Otoscope	1	NLM	NLM	1			1			1	1	1		1
WELCH ALLYN fiber optic cable	Otoscope	1	NLM	NLM	1			1			1	1	1		1
WELCH ALLYN fiber optic cable coupler	Otoscope	1	NLM	NLM	1			1			1	1	1		1
WELCH ALLYN power cable	Otoscope	1	NLM	NLM	1			1			1	1	1		1
WELCH ALLYN S-video cable	Otoscope	1	NLM	NLM	1			1			1	1	1		1
WELCH ALLYN manual	Otoscope	1	NLM	NLM	1			1			1	1	1		1
WELCH ALLYN Spare bulbs	Otoscope	2	NLM	NLM	2			2			2	2	2		2
MEDRX Complete system	Otoscope	1	KOTZ	KOTZ		1	1		1	1				1	
MEDRX Specula?	Otoscope	1	KOTZ	KOTZ		1	1		1	1				1	
Total for Box: Otoscope					10	2	2	10	2	2	10	10	10	2	10
HEWLETT PACKARD HP720C printer	Printer	1	ALL	DEPENDS	1	1	1	1	1	1	1	1	1	1	1
HEWLETT PACKARD printer power supply	Printer	1	ALL	DEPENDS	1	1	1	1	1	1	1	1	1	1	1
Total for Box: Printer					2	2	2	2	2	2	2	2	2	2	2
GATEWAY Speakers - pair	Speakers	1	ALL	DEPENDS	1	1	1	1	1	1	1	1	1	1	1
GATEWAY Speakers power supply	Speakers	1	ALL	DEPENDS	1	1	1	1	1	1	1	1	1	1	1
GATEWAY Speakers cable	Speakers	1	ALL	DEPENDS	1	1	1	1	1	1	1	1	1	1	1
GATEWAY Speakers manual	Speakers	1	ALL	DEPENDS	1	1	1	1	1	1	1	1	1	1	1
Total for Box: Speakers					4	4	4	4	4	4	4	4	4	4	4

Inventory to Ship to Kotzebue (ordered by Box Name)

DESCRIPTION	Box Name	Quantity per Site	What Villages get Equipment	Who Pays for Equipment	QUANTITY (and who pays) FOR EACH LOCATION										
					Ambler NLM	Buckland KOTZ	Deering KOTZ	Kiana NLM	Kivalina KOTZ	Kobuk KOTZ	Noatak NLM	Noorvik NLM	Selawik NLM	Shungnak KOTZ	Kotzebue NLM
GATEWAY - CPU	CPU	1	ALL	DEPENDS	1	1	1	1	1	1	1	1	1	1	1
GATEWAY - CPU powercord	CPU	1	ALL	NLM	1	1	1	1	1	1	1	1	1	1	1
GATEWAY - keyboard	CPU	1	ALL	DEPENDS	1	1	1	1	1	1	1	1	1	1	1
GATEWAY - mouse	CPU	1	ALL	DEPENDS	1	1	1	1	1	1	1	1	1	1	1
GATEWAY - mousepad	CPU	1	ALL	DEPENDS	1	1	1	1	1	1	1	1	1	1	1
6' Parallel printer cable (IEEE 1284 cable)	CPU	1	ALL	DEPENDS	1	1	1	1	1	1	1	1	1	1	1
Black ink cartridge for HP722C/HP720C	CPU	3	ALL	NLM	3	3	3	3	3	3	3	3	3	3	3
Color ink cartridge for HP722C/HP720C	CPU	3	ALL	NLM	3	3	3	3	3	3	3	3	3	3	3
LABTEC AM-32 Microphone	CPU	1	ALL	NLM	1	1	1	1	1	1	1	1	1	1	1
FLASHBUS MV Pro	CPU	1	ALL	DEPENDS	1	1	1	1	1	1	1	1	1	1	1
FLASHBUS cables	CPU	1	ALL	DEPENDS	1	1	1	1	1	1	1	1	1	1	1
MATROX Millenium II AGP version with 4 Meg RAM	CPU	1	ALL	DEPENDS	1	1	1	1	1	1	1	1	1	1	1
US ROBOTICS 56K V.Everything modem internal.	CPU	1	ALL	DEPENDS	1	1	1	1	1	1	1	1	1	1	1
US ROBOTICS - 6' modem cable	CPU	1	ALL	DEPENDS	1	1	1	1	1	1	1	1	1	1	1
GATEWAY - software 2 ring binder	CPU	1	ALL	NLM	1	1	1	1	1	1	1	1	1	1	1
GATEWAY - "Using Your Gateway PC"	CPU	1	ALL	NLM	1	1	1	1	1	1	1	1	1	1	1
GATEWAY - "Maintaining and Troubleshooting your Gateway PC"	CPU	1	ALL	DEPENDS	1	1	1	1	1	1	1	1	1	1	1
GATEWAY - "Gateway Gold Service and Support"	CPU	1	ALL	DEPENDS	1	1	1	1	1	1	1	1	1	1	1
GATEWAY - System CD version 3.1 CDROM	CPU	1	ALL	NLM	1	1	1	1	1	1	1	1	1	1	1
GATEWAY - Online Component Manuals CDROM	CPU	1	ALL	NLM	1	1	1	1	1	1	1	1	1	1	1
GATEWAY - System Disk 3.5"	CPU	1	ALL	DEPENDS	1	1	1	1	1	1	1	1	1	1	1
GATEWAY - Wiring Diagram	CPU	1	ALL	DEPENDS	1	1	1	1	1	1	1	1	1	1	1
3COM - Etherlink Manual and (2) disks	CPU	1	ALL	NLM	1	1	1	1	1	1	1	1	1	1	1
MICROSOFT - Office 97 Small Business Edition CDROM, Financial Manager 97 manual, and license	CPU	1	ALL	NLM	1	1	1	1	1	1	1	1	1	1	1
MICROSOFT - Bookshelf 98 CDROM	CPU	1	ALL	NLM	1	1	1	1	1	1	1	1	1	1	1
MICROSOFT - Streets 98 CDROM	CPU	1	ALL	NLM	1	1	1	1	1	1	1	1	1	1	1
MICROSOFT - Windows 95 CDROM, manual and license	CPU	1	ALL	DEPENDS	1	1	1	1	1	1	1	1	1	1	1
MICROSOFT - Internet Explorer v4.01 CDROM	CPU	1	ALL	NLM	1	1	1	1	1	1	1	1	1	1	1
FLASHBUS - Manual, (2) 3.5" disks	CPU	1	ALL	NLM	1	1	1	1	1	1	1	1	1	1	1
US ROBOTICS - Manual, registration card, CDROM, Quick Reference card	CPU	1	ALL	NLM	1	1	1	1	1	1	1	1	1	1	1
MATROX - manual, CDROM, AGP Addenda	CPU	1	ALL	NLM	1	1	1	1	1	1	1	1	1	1	1
Template for drilling holes in cart	CPU	1	ALL	NLM	1	1	1	1	1	1	1	1	1	1	1
DO NOT SEND THE MONITOR CALIBRATION CARD ENCLOSED WITH THE MATROX CDROM	CPU	0	ALL	NLM	0	0	0	0	0	0	0	0	0	0	0
Total for Box: CPU					**36**	**36**	**36**	**36**	**36**	**36**	**36**	**36**	**36**	**36**	**36**

Inventory to Ship to Kotzebue (ordered by Box Name)

DESCRIPTION	Box Name	Quantity per Site	What Villages get Equipment	Who Pays for Equipment	QUANTITY (and who pays) FOR EACH LOCATION										
					Ambler NLM	Buckland KOTZ	Deering KOTZ	Kiana NLM	Kivalina KOTZ	Kobuk KOTZ	Noatak NLM	Noorvik NLM	Selawik NLM	Shungnak KOTZ	Kotzebue NLM
WELCH ALLYN Disposable Welch Allyn 2.5 mm specula - bag of 1,000	Cart Hardware	0.5	NLM	NLM	0.5			0.5			0.5	0.5	0.5		0.5
WELCH ALLYN Disposable Welch Allyn 4 mm specula - box of 1,000	Cart Hardware	0.5	NLM	NLM	0.5			0.5			0.5	0.5	0.5		0.5
WELCH ALLYN Probe	Cart Hardware	1	NLM	NLM	1			1			1	1	1		1
WELCH ALLYN Insufflator bulb	Cart Hardware	1	NLM	NLM	1			1			1	1	1		1
25' power extension cord	Cart Hardware	1	ALL	NLM	1	1	1	1	1	1	1	1	1	1	1
25' - 50' male-Female Modem cord	Cart Hardware	1	ALL	NLM	1	1	1	1	1	1	1	1	1	1	1
Dust Cover (eg. Sheet)	Cart Hardware	1	ALL	NLM	1	1	1	1	1	1	1	1	1	1	1
HARDWARE BAG - with (4) each of 1 1/2" bolts, nuts and locking washers	Cart Hardware	1	ALL	NLM	1	1	1	1	1	1	1	1	1	1	1
HARDWARE BAG - with (4) each of Phillips-head (#10, 2") screws	Cart Hardware	1	ALL	NLM	1	1	1	1	1	1	1	1	1	1	1
FASTENER BAG - with all Velcro and fasteners for workstation	Cart Hardware	4	ALL	NLM	4	4	4	4	4	4	4	4	4	4	4
Total for Box: Cart Hardware					12	9	9	12	9	9	12	12	12	9	12
ToolBox	Toolkit	1	ALL	NLM											1
Rubber mallet	Toolkit	1	ALL	NLM											1
Needlenose pliers	Toolkit	1	ALL	NLM											1
Screwdriver - Anthro 5/32 hex	Toolkit	1	ALL	NLM											1
Screwdriver - slotted	Toolkit	1	ALL	NLM											1
Screwdriver - phillips	Toolkit	1	ALL	NLM											1
Center Punch	Toolkit	1	ALL	NLM											1
Bent hex key driver	Toolkit	1	ALL	NLM											1
Flashlight	Toolkit	1	ALL	NLM											1
Utility knife	Toolkit	1	ALL	NLM											1
Extra utility knife blades	Toolkit	1	ALL	NLM											1
Tape measure - 8'	Toolkit	1	ALL	NLM											1
Drill bit - hex driver (Anthro)	Toolkit	1	ALL	NLM											1
Drill bit - 5/16"	Toolkit	2	ALL	NLM											2
Drill bit - 1/4"	Toolkit	2	ALL	NLM											2
Drill bit - 1/8"	Toolkit	2	ALL	NLM											2
Screwdriver - Phillips No. 2	Toolkit	1	ALL	NLM											1
Wrench - 7/16" combination	Toolkit	1	ALL	NLM											1
Permanent Marker Pen - Sharpie	Toolkit	1	ALL	NLM											1
Pen	Toolkit	1	ALL	NLM											1
Cable Ties - Large White	Toolkit	1	ALL	NLM											1
Cable Ties - Small White	Toolkit	1	ALL	NLM											1
Cable Ties - Large Black	Toolkit	1	ALL	NLM											1
Cable Ties - Small Black	Toolkit	1	ALL	NLM											1
Extension cord - 25'	Toolkit	1	ALL	NLM											1
Staple gun	Toolkit	1	ALL	NLM											1
Staples - 1/2"	Toolkit	1	ALL	NLM											1
Staples - 5/16"	Toolkit	1	ALL	NLM											1
Drill - Black and Decker	Toolkit	1	ALL	NLM											1
Total for each: Toolkit															32

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A. Stewart Ferguson
Alaska Telemedicine Testbed Project

Inventory to Ship to Kotzebue (ordered by Box Name)

DESCRIPTION	Box Name	Quantity per Site	What Villages get Equipment	Who Pays for Equipment	QUANTITY (and who pays) FOR EACH LOCATION										
					Ambler	Buckland	Deering	Kiana	Kivalina	Kobuk	Noatak	Noorvik	Selawik	Shungnak	Kotzebue
					NLM	KOTZ	KOTZ	NLM	KOTZ	KOTZ	NLM	NLM	NLM	KOTZ	NLM
MANUAL - "Building cart ..."	Documentation	1	ALL	NLM											1
SURVEY - "Telemedicine Hardware Installation" - 10 copies for each installer kit, otherwise 1 copy in other packets	Documentation	10	ALL	NLM											10
SPREADSHEET - "Anthro Order ..."	Documentation	1	ALL	NLM											1
SPREADSHEET - "Serial Numbers ..."	Documentation	1	ALL	NLM											1
MANUAL - "Configuration of Gateway Computers ..."	Documentation	1	ALL	NLM											1
MANUAL - "Preparation of Gateway Computers ..."	Documentation	1	ALL	NLM											1
MANUAL - "Preparation of Gold Hard Disk ..."	Documentation	1	ALL	NLM											1
MANUAL - "Testing Workstation..."	Documentation	1	ALL	NLM											1
SPREADSHEET - "Inventory to ship to ..."	Documentation	1	ALL	NLM											1
TEMPLATE - CPU - All Carts - Bottom Shelf	Documentation	1	ALL	NLM											1
TEMPLATE - MONITOR - All Carts - Middle Shelf	Documentation	1	ALL	NLM											1
TEMPLATE - SPEAKER - 24" & 30" Clinic Cart - Middle Shelf	Documentation	1	ALL	NLM											1
TEMPLATE - SPEAKER - 24" Hospital Cart - Middle Shelf	Documentation	1	ALL	NLM											1
Total for each: Documentation															**22**
CardBoard Inlay for drilling holes	Miscellaneous	1	ALL	NLM											1
Compressed air	Miscellaneous	1	ALL	NLM											1
Drive Image disks (set for Win95 and set for WinNT)	Miscellaneous	2	ALL	NLM											2
Sony Mavica Camera with battery charger	Miscellaneous	1	ALL	NLM											1
Drive Image equipment - floppy disks, external drive(?), image disks (?)	Miscellaneous	1	KOTZ	NLM											1
Black ink cartridge for HP722C/HP720C	Miscellaneous	15	KOTZ	NLM											15
Color ink cartridge for HP722C/HP720C	Miscellaneous	15	KOTZ	NLM											15
LABTEC AM-32 Microphone	Miscellaneous	5	KOTZ	NLM											5
FLASHPOINT 128 CARD	Miscellaneous	1	ALL	NLM											1
TEMPLATES - Drill holes for bottom of CPU	Miscellaneous	1	ALL	NLM											1
TEMPLATES - Drill holes for CPU after drilling holes	Miscellaneous	10	ALL	NLM											10
MAILING LABELS - Small (blank)	Miscellaneous	3	ALL	NLM											3
MAILING LABELS - Village Names	Miscellaneous	4	ALL	NLM											4
MAILING LABELS - Computer Equipment to Kotzebue for each village (large labels)	Miscellaneous	1	ALL	NLM											1
MAILING LABELS - Computer Equipment to each village clinic (large labels)	Miscellaneous	1	ALL	NLM											1
MAILING LABELS - Carts to each village clinic (large labels)	Miscellaneous	1	ALL	NLM											1
TEST MATERIALS - 3.5" floppy disk	Miscellaneous	1	ALL	NLM											1
TEST MATERIALS - CDROM disk	Miscellaneous	1	ALL	NLM											1
Total for each: Miscellaneous															**65**

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Inventory to Ship to Kotzebue (ordered by Box Name)

DESCRIPTION	Box Name	Quantity per Site	What Villages get Equipment	Who Pays for Equipment	QUANTITY (and who pays) FOR EACH LOCATION										
					Ambler NLM	Buckland KOTZ	Deering KOTZ	Kiana NLM	Kivalina KOTZ	Kobuk KOTZ	Noatak NLM	Noorvik NLM	Selawik NLM	Shungnak KOTZ	Kotzebue NLM
WELCH ALLYN Disposable Welch Allyn 2.5 mm specula - bag of 1,000	To Be Left In Drawer	0.5	NLM	NLM	0.5			0.5			0.5	0.5	0.5		0.5
WELCH ALLYN Disposable Welch Allyn 4 mm specula - box of 1,000	To Be Left In Drawer	0.5	NLM	NLM	0.5			0.5			0.5	0.5	0.5		0.5
WELCH ALLYN 45mm Coupler	To Be Left In Drawer	1	NLM	NLM	1			1			1	1	1		1
WELCH ALLYN Probe	To Be Left In Drawer	1	NLM	NLM	1			1			1	1	1		1
WELCH ALLYN Fibre Optic cable	To Be Left In Drawer	1	NLM	NLM	1			1			1	1	1		1
WELCH ALLYN fiber optic cable coupler	To Be Left In Drawer	1	NLM	NLM	1			1			1	1	1		1
WELCH ALLYN camera with cable	To Be Left In Drawer	1	NLM	NLM	1			1			1	1	1		1
WELCH ALLYN Insufflator bulb	To Be Left In Drawer	1	NLM	NLM	1			1			1	1	1		1
WELCH ALLYN S-video cable	To Be Left In Drawer	1	NLM	NLM	1			1			1	1	1		1
WELCH ALLYN manual(s)	To Be Left In Drawer	1	NLM	NLM	1			1			1	1	1		1
WELCH ALLYN Spare bulbs	To Be Left In Drawer	2	NLM	NLM	2			2			2	2	2		2
MEDRX Camera	To Be Left In Drawer	1	KOTZ	KOTZ		1	1		1	1				1	
MEDRX Probe	To Be Left In Drawer	1	KOTZ	KOTZ		1	1		1	1				1	
MEDRX Fiber optic cable	To Be Left In Drawer	1	KOTZ	KOTZ		1	1		1	1				1	
MEDRX Camera cable	To Be Left In Drawer	1	KOTZ	KOTZ		1	1		1	1				1	
MEDRX Specula	To Be Left In Drawer	1	KOTZ	KOTZ		1	1		1	1				1	
MEDRX Manual(s)	To Be Left In Drawer	1	KOTZ	KOTZ		1	1		1	1				1	
Black Ink cartridge for HP722C/HP720C	To Be Left In Drawer	3	ALL	NLM	3	3	3	3	3	3	3	3	3	3	3
Color Ink cartridge for HP722C/HP720C	To Be Left In Drawer	3	ALL	NLM	3	3	3	3	3	3	3	3	3	3	3
Anthro Tools	To Be Left In Drawer	1	ALL	NLM	1	1	1	1	1	1	1	1	1	1	1
Software, manuals, disks (that are not to be returned to regional facility)	To Be Left In Drawer	1	ALL	NLM	1	1	1	1	1	1	1	1	1	1	1
SONY Mavica FD7 or Olympus camera	To Be Left In Drawer	1	ALL	KOTZ	1	1	1	1	1	1	1	1	1	1	1
Total To Be Left In Drawer					**20**	**15**	**15**	**20**	**15**	**15**	**20**	**20**	**20**	**15**	**20**
Q-tips for mouse cleaning	Training Kit	1	ALL	NLM	1	1	1	1	1	1	1	1	1	1	1
Alcohol pads for otoscope cleaning	Training Kit	1	ALL	NLM	1	1	1	1	1	1	1	1	1	1	1
Screen wipes for cleaning monitor	Training Kit	1	ALL	NLM	1	1	1	1	1	1	1	1	1	1	1
Monitor calibration kit	Training Kit	1	ALL	NLM	1	1	1	1	1	1	1	1	1	1	1
Screwdriver - Phillips No. 2	Training Kit	1	ALL	NLM	1	1	1	1	1	1	1	1	1	1	1
Wrench - 7/16" combination	Training Kit	1	ALL	NLM	1	1	1	1	1	1	1	1	1	1	1
Bilbo foot pedals or other trigger device (NOTE: this may be a custom device rather than Bilbo)	Training Kit	1	ALL	NLM	1	1	1	1	1	1	1	1	1	1	1
Drive image equipment - floppy disks, external drive(?), image disks (?)	Training Kit	1	ALL	NLM	1	1	1	1	1	1	1	1	1	1	1
Total for Box: Training Kit (to be supplied at a later date by trainers)					**8**	**8**	**8**	**8**	**8**	**8**	**8**	**8**	**8**	**8**	**8**

7.42

TRAVEL ACTIVITIES REPORT

Name: A. Stewart Ferguson

Dates of travel: 1/18/99 - 1/27/99

Traveled to: Kotzebue

Purpose of travel: Install telemedicine software, prepare for trainers.

EXPENSES

Cost Code	Description	Amount
	Airfare (Alaska Airlines - apparently the confirmed reservation was not paid ahead of time)	$399.00
	Additional baggage (5 otoscopes, 4 boxes with equipment)	$150.00
	1/18/99 Cab fare	$11.00
	1/27/99 Cab fare	$12.00
	1/27/99 Cab Fare	$6.00
	1/27/99 Hotel	$595.25
	Cost to adjust return leg of trip	$35.00
	TOTAL (Miscellaneous expenses)	**$1208.25**

PURPOSE

The purpose of this trip was to:

- Upgrade the telemedicine hardware at the Maniilaq Health Center (MHC),
- Provide hardware upgrade "kits" with instructions to the MHC IS staff who would then process the upgrades at each village
- Train the IS staff on the hardware upgrades.
- Upgrade five villages from MedRx to Welch Allyn otoscopy equipment
- Refine the telemedicine software to work within the MHC WAN, using the existing Exchange server and existing WAN connections.
- Install telemedicine software on local workstations within MHC to generate and respond to telemedicine cases.
- Develop a deployment plan (complete with CDROM software and instructions) to allow the telemedicine software to be loaded by IS staff onto telemedicine workstations in the villages.
- Train the MHC IS staff on software deployment.
- Provide technical support (and debug problems) for the telemedicine trainers slated to arrive later in my trip.

DETAILS

The trip was planned two weeks in advance, and I flew to Kotzebue as scheduled despite a) the lack of software that provided needed features from Medvision, b) the fact that our "smart form" software worked flawlessly but did not yet work as a "snapin" to the Medvision software, c) a box of important hardware upgrades for all Welch Allyn equipment (from American Medical Development) did not arrive due to weather problems in Boston, and d) the fact that several villages in the Maniilaq region did not have working WAN connections, and e) the IS staff at MHC had been unable to reach any villages for more than a week due to poor weather.

We recognized the need to prevent further delays in the rollout schedule, so I flew to Maniilaq despite these problems. However, this meant that I needed to create an entire test facility in Maniilaq - meaning a

development workstations for writing and testing code, a working telemedicine workstations on which to load and generate deployment software, a CDROM burner to develop deployment CDs, a strategy for moving test code back and forth to the Medvision developer, etc. The development workstation was a particularly irksome issue because Maniilaq has no Windows NT workstations. Developing and testing code on the existing Windows 98 computer at Manillaq caused repeated system crashes (at one point - over 30 in a single day). This was often due to the continued problems with getting a stable software package from Medvision in addition to the need to make the "smart forms" work as a snapin to that code.

The first priority was working with Jonathan Woods at Medvision to generate "stable" code. This was not an issue of adding features to the code, but rather making the existing features work without crashes or freezes. Once a "stable" program was available, it was necessary to start from scratch to develop an image of the workstation hard disk that could be duplicated onto all other workstations (loading Windows NT, Service Pack 3, Internet Explorer, Service Pack 4, Outlook, Office 97, UPS software, over 10 more applications and approximately 10 different driver packages, etc - a 15 page manual describes this process). Unfortunately, the same workstations needed to be used for training purposes, so I had to be available during the daytime hours for the obvious bugs that occurred, then work during the night to develop the deployable software. Naturally we ran into some conflicts over the availability of the workstation.

RESULTS

The first week (1/18-1/22) was spent developing software, as well as developing training materials and training the MHC IS staff on the hardware upgrades. The IS staff tried repeatedly -- on a daily basis -- to get out to the villages but were unable to fly due to weather conditions. Once the hardware upgrades arrived from AMD, it was necessary to develop an instructional manual on those upgrades and to again train the staff on those materials. Several days were spent developing training materials and training the staff, while the remaining days and every evening was spent working towards stable software.

The second week started with the trainers arriving on the Sunday (1/24), with two trainers immediately flying out to villages that same day. The MHC IS staff was unable to follow because they needed a larger aircraft (due to the amount of hardware they were taking) but the only airline with the larger airplane need to fly other cargo that day and would not fly the requested charter flight. We did not supply the trainers with software to take to the villages, because we expected the IS staff to be following in a day with both hardware and software.

The training started on Monday at 8:30 at Maniilaq, and software was available and running for the MHC trainer. We found a few problems in the software that were quickly resolved, and overall the software worked well. The original plan was to allow the trainer to use the telemedicine workstations from 8:30 am to 10 am, after which I would be able to start developing the deployment CDROMs. However, the trainer requested additional time on the workstations and I did not start developing the deployment CDROMS until 6 pm. It required the entire nightime, but a deployment package was ready by 8am Tuesday and CDROM's were provided to the IS staff members who flew to 4 villages on Tuesday morning.

Unfortunately, there was not enough time overnight to also develop an instruction manual to accompany the CDROM, so I needed to use the telemedicine workstation Tuesday morning to develop this manual. I regret that the trainer was unable to use the workstation that morning - but I felt it was more important to take care of the 4 installers in the villages since I was unsure when we would get a weather break to install the software at a later time. The telemedicine workstation was available for the trainer by lunchtime.

Again, we found some problems related to the deployment of the software and the afternoon was spent tracking down those issues. I again received the workstations back at 6 pm Tuesday, and spent the next 8 hours providing technical support to the IS staff at the villages for installing the software. That time was also spent developing an "easier" CDROM installation for Noatak and Kivalina that could be shipped to Destyne Taft.

By Wednesday morning, all 4 villages had successfully installed and tested software. The CDROMS for Destyne were weather delayed, but eventually reached her in Noatak around 5pm that day. I provided assistance to Destyne to install the software, and the following day provided the same assistance to her in Kivalina.

As it currently stands, we now have software loaded and tested in 6 villages (Noatak, Kivalina, Buckland, Ambler, Shungnak, and Kobuk) as well as Kotzebue.

CONCERNS

While significant progress was made on this trip to Kotzebue, the fact that software became available hours before the arrival of the trainers exerted significant strain on everyone involved. This was only due to the inability to get a stable version of the software that supported the snapin. It was not a result of adding features, but rather it was the decision to cut features that allowed any software to be available. Most significantly, the Medvision software does not currently support printing of images, transmission of annotations, or the remote trigger devices. The smart form also has occasional problems accessing the local database.

The deployment of the software allowed a number of "bugs" and "missing features" to be identified by trainers and health aides. The plan is to immediately start working on resolving the most significant of these problems. The following software problems have bee identified:

Priority	Description
High	Printing of images does not work correctly - occasionally crashes the software. Clicking on one image, then right clicking a different image causes a crash. How does the software deal with one enclosure being presented when an other enclosure gets a right click?
High	Deleting an enclosure does not work "well". The list of enclosures does not get repainted.
High	What determines the order of enclosures? It is not consistent with the order in which they are inserted.
High	Tool for configuring the snapins always ignores the first alphabetic snapin - which is out acquisition snapin.
High	Sending and receiving annotations does not work. The default for displaying annotations should always be "on", meaning that annotations get displayed if they are there rather than the default being to hide them.
Medium	Can we use a GUID for the image filename - and perhaps all enclosures - so that the smart form can iterate through all the enclosures to find the GUID filenames and print them as a list of attachments. Could we also find a way for a smart form to call the printing routine of each image to do thumbnails of the images on the form?
High	Drag and drop of *.txt files freezes Outlook. Presume this is another snapin. We might want the ability to drag and drop RTF documents. I could simply write a text snapin if you do not have one ready.
High	Need to make the serial trigger device work with the image capture snapin.
High	Allow users to modify the smart form until the case is sent, similar to the ability to add consults to the case once it is received.
High	Do not allow users to modify any enclosures, to delete enclosures, or to add enclosures when a case is in "read only" mode (meaning that the message has been "sent")
Medium	Can we set the default annotation tools via the configuration tool? Or via registry changes?
Low	There is an obvious problem with the Medvision software in the WindowsNT Registry whereby the software has to be loaded while logged in as the final user. The "workaround" to this was to save the registry settings after software installation to a text file, then restore the registry settings as the new user.
High	When changing annotations - the software only prompts to save the changes when moving to another image but not if the case gets closed. Furthermore, the prompt "Save

Priority	Description
	Annotations to image" only has a "yes" option. It needs a "No" and "Cancel".
High	The enclosure name for all images is "Image". Need to modify the code to start with "Image 1", then "Image 2", etc. We worked a little bit on this - and the subroutines is finally working correctly - just needs to be incorporated into the drop.
Low	We need to hide the Global Address Book to prevent the users from transmitting cases outside the designed telemedicine system. Also need to restrict the ability to send and receive cases outside the system. For the villages, this means transmitting only to other villages or the health center within the region.
Medium	The "Synchronizing Folders" activity takes too long when shutting down the system - we need to eliminate this or speed it up.
Medium	Exporting enclosures is important for regional doctors - to send images outside of this system.

ATTP Deployment - Noatak
January 24 – 28, 1999
By Destyne Taft

Sunday 1/24/99

Travel: Anchorage to Kotzebue to Noatak; most planes were grounded, except small charters, which we had arranged, so I took advantage of the reservation and went on out to Noatak. An easy flight, just very cold.

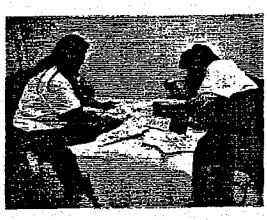
Activities:

Introductions to health aides, learn that Sunday night is important church gathering, plan to attend. Stow food and goodies, ready for breakfast tomorrow.
Turn on TM Workstation (TmW), check connectivity, talk with Stewart and Eugene, and get familiar with its current capabilities until time for church.
6:00 – 8:30 PM Community gathering, exposure to community at large, sermon on forgiveness.

Monday 1/25/99

No Travel

Activities:



Day begins at 8:00 AM, HAs arrive promptly, introductions, overview and discussion according to plan. Fun and ease are accentuated. 4 HA, Esther, Victoria, Cheryl, Violet. Fill out forms for CME, follow curriculum. Lunch is always from 12-1PM. Community is trained to this schedule. I use time to connect with Kotz, check status, report problems.

Day progresses as planned, except that HAs must also man the clinic, as relief has not arrived. This means broken stretches of concentration, but we emphasize so much repetition, that they seem to do OK.

No software available, so we focus on tools, the otoscope, the camera, everyone uses them.

These HAs have been waiting for some time for this technology and they take to it well. We are able to work on finesse as well as general use on the tools. I demonstrate one full event (without software) and then we break down each segment, getting familiar with each tool.

Evening is spent on phone with Stewart, I check limitations of TmW and report to Maniilaq. Test CDRom, the PPT show works well, but will not read short video on Earwax Removal. I think there is something wrong with setting, perhaps memory associated with video? Machine not prepared to handle this portion of the training material. Learn that the new desktop computers installed by Maniilaq may be better suited. It does work better. These CDs were all tested at the lab, Stewart thinks the computers in the lab are configured differently than the TmW. It should be resolved whatever the reason. Especially since it is known that the workstations are intended to play video produced at the UAA Lab.

Problems: No software, CDROM will not play video clips on TmW, (I think it is related to memory, the video broke up at different places, would loose A/V sync and get pixilated at odd times. Copying the video clip to the harddrive may have made a difference, but didn't try that.

Successes: We were able to study and run the clinic at the same time, but the HAs had informed the village of our presence and they knew not to come unless necessary. Our curriculum gave us enough to do to allow for stalling until the software arrives.

Tuesday 1/26/99

No Travel

Activities:

Early start, continue with planned curriculum, also taking note of HA Skills list, filling it out as possible. I am concerned about the CME credit and passing the skills list because of software dilemma. Will check with Denise on this.

More practice and if clinic traffic made things difficult, we would take a break and view the PPT slide show and video on wax removal. Lots of repetition, open a new case (preaddressed) insert video, still images and we studied the workstation manual closely. Some as a group, some individually. Spent extra time with Cheryl for trainer's training. Additional troubleshooting skills for her as well.

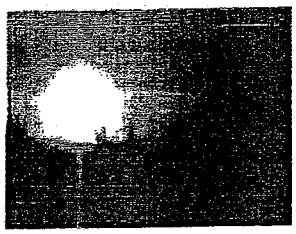
Between the four of them, they had every needed skill. They are all computer literate. Esther is a little slow typing, but she is a senior HA with advanced clinical skills. Violet is savvy with Word, email and more. Vicky was very comfortable on all fronts and had administrative issues to handle. Cheryl is a good communicator, jolly and confident, hungry to know more and took to everything very well. We probably couldn't have had a better village to start with.

Carrie and Opal arrive with two itinerant HA to cover clinic while we study. Afternoon arrival allows for orientation and not much more in terms of training. We have had a full morning and HAs are excited and practicing on equipment all day. Several patients come in and we do actual image captures for them to see. Can't send the images anywhere without software, but it served as good PR.

Spend afternoon on the Suicide CD, very intense, took 90 minutes to do it and talk with each other throughout. They were each personally familiar with such tragedy. It almost served as an opportunity to debrief for them on some past issues. They seemed to need it, so we stayed with the subject as long as they needed.

Problems: No software. Are all CME credits coming out of Kuskokwim campus? What is the difference between Linda Kurda/Destyne Taft role - on these forms, not in life in general?

Successes: The flow of the curriculum is good, it builds on skills learned and we would repeat often. In slow times, when some were called to work, I would do one-on-one and work with them on their specific interests or concerns. This was advantageous when we got back together as a group; folks were on even levels. I also trained some "value-added" skills during these times according to their interest and skills, such as how to build a personal address book for email. This was taught on the clinic desktop, not the TmW.



Wednesday 1/27/99

No Travel
Activities:

Clinic full of people at 8:00 AM – me, Carrie, Opal, 4 resident HA and 2 itinerant HA. Too many people, but we worked with it. More curriculum activities, practicing, attaching images, going over basic concepts in computer world in general and devoted time to printed manual and the forms sections.

Carrie also spent quality time from a clinical point of view and oversaw the CHAM skills portion of the skills list. I also observed their use of the CHAM while serving patients. Was glad to listen to Carrie providing more clinical perspective, to help me in Kivalina later.

Software arrived in afternoon. Clinic got busy as well.

Spent the evening on the phone with Stewart doing the install. His instructions were good except for one part, which tripped all three of us up for some reason. (Carrie, me and Opal) We moved the workstation around, over to the main office so we could work and talk on phone at same time. Long phone conversation.

Spent more time on the software in the evening to prepare for teaching tomorrow.

NOTE: We had been using the term "still image" for the digital camera and video capture for the otoscope. These terms are different on the software, still image capture means otoscope. They were all comfortable with the click and drag technique for the floppy drive that we had practiced these past days.

Problems: Tried to find bugs in software that night, before training tomorrow. I tried to generalize concepts these past few days so that they would understand that regardless of what a form actually looked like, there would be basic things that had to be done. It seemed to work as we found out later.

They may have time to enter village patients into the database early. Could not see and easy way to do that with current version of software?

Successes: When clinic relief arrived and they could concentrate, it appeared that we had done a lot and they were ready to do solo runs, practice patient visits and get more finesse. By this time we had entered everyone in the computer as well.

Thursday 1/28/99

Travel: Later afternoon to Kivalina
Activities:

Focus only on software today. They seem very competent on all other aspects, just need more time to practice. I am hoping to travel to Kivalina today. Temperatures warm to –40.

Each HA had at least 2 tries at the entire process of form generation and attaching images, sending to several locations. We had been filling in our own subject line, so it was easier now with the software doing it automatically.
Completed skills list on all HA and they did evaluations. SEE ENCLOSED

Problems: Very difficult to put HA at ease with so many bugs. Hard to remember if it was their problem or software dilemma. Right mouse was the strangest thing to learn, but we practiced until it was easy. Discovered several bugs there.

1. **Subject line features** the clinic and number of messages sent. This was not important to them, other items like patient name, assessment and date were more important to them.
2. **Synchronizing folders** at the end of the day took 20 minutes. They will plan their day accordingly to handle this.
3. It is critical that they **be able to move in and out of forms and images from within a message** (before sending it). It was not possible to take images, remember what you wanted to say all the way to the end of the form. Once a form is closed it can not be reopened without sending, retrieving and adding a consult.
4. **Attachments in Enclosures Box**: right mouse only allowed for Renaming. Other features such as Delete, Print, Export Enclosure were non-functional.
5. In new message, if images were loaded first, **Forms would present Error 429** and it was necessary to close out of Outlook completely, come back in to Outlook, find the unsent message in Draft Box in Outlook, open message, then try and open Form, but by then, they needed to recheck the images and couldn't do that of course without closing out the Forms. VERY DIFFICULT to train through this bug.
6. **Foot pedal, handheld red button and Fergatron** were non-functional. They practiced training patients to use mouse and "Grab Image" or used extra HA.
7. **Address book** is currently set under Personal Address Book with all the "telemedicine" addresses. Other options exist like Global Addresses, which accessed Maniilaq list and more. Carrie was concerned about confidentiality. She wondered if there was a way to close out other addresses? I do not support that option, but spent time discussing it in training mode anyway. These HA understand issues of confidentiality and knew the difference in addresses.
8. **Otoscope barrel never arrived. Managed to find specula that fit.**

Successes: They all reported feeling comfortable with the whole process and looked forward to practicing more. Also covered administrative needs as well, such as lots of floppy disks for storing images and they worked with Opal on storage packets that will fit in patient record.

Flew to Kivalina for late afternoon arrival. Very cold flight

ATTP Deployment - Kivalina
January 28- 30, 1999
By Destyne Taft

Thursday – 1/28/99

Travel: Noatak to Kivalina, traveling with Esther Barber who will cover the clinic while we train.

Activities: Afternoon arrival. Introductions and overview/orientation segment of curriculum covered. Preparing for real work tomorrow. Fill out CME forms and go over folder contents. Accentuate the "fun" we are going to have, stresslessness of it and they seem ready and excited. Unpack food and goodies for everyone.

Henrietta (Etta), Isabelle and Myra and are ready to practice and play.

Check workstation immediately, not connected to network, arrange to talk with Stewart at end of day for install and fix-its as necessary. Not fully assembled as I find parts all over the work area in numerous boxes. Drawer is not attached. Discover a bad network cable, switch it out with desktop cable. Also, problems with wall switch for power and network router box. Change out otoscope as well. (This arrived with software in Noatak) Box up MedRx otoscope.

Stewart and I spend long time on phone, extensive problems with network connectivity and workstation. This was a productive session, problems were numerous and diverse, but much was accomplished. He walked me through some things and others I took care of during slow sessions at the clinic.

1. UPS did not work at first attempt, apparently needed to warm up or something. Worked by the time Stewart was on the phone. But connections to wall socket is still wimpy.
2. Make change to card inside CPU.
3. Make network connection directly through router after tracing cables to outlets (determined that the wall outlet for network connection may not be working. Power outlet next to workstation is also very tenuous and loose. We use tape to secure it. Attach UPS to a surge protector.
4. Network cable was bad, replaced it with one off the desktop.
5. Installed AMD otoscope, couldn't find video cable for it, Stewart found it in case lid, under foam pad!
6. Cable management of the whole process took time, unraveling otoscope, rewrapping additional cables.
7. Installed the software and made those numerous changes.
8. Installed the cart drawer before leaving on Saturday.

Evening was very busy in the clinic. Very sick patient on fluid IV for much of the evening. Many towns' people came to visit. I used opportunity to PR the project. Late to bed. Temperatures reported to be 90-100 below.

Friday – 1/29/99

No Travel:

Activities:

Clinic is very busy. HAs somewhat distracted at first, but then things get rolling. Two actual ear patients during lunch break, Esther and I take pictures and do an entire case, sending it to Kotz with special notation

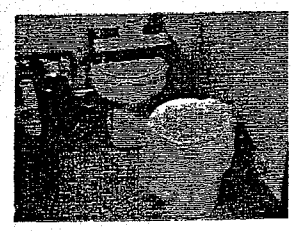
in subject line that it was for real patients. (Had made copies of the new consent form upon arriving so we had ones to use.)

Also took pictures of interesting stuff, such as this avulsed finger.

Followed curriculum, which goes very smoothly. Play with all aspects of workstation, otoscope and camera. Save the forms for last. A full day with clinic coverage made it much easier. But still hard to stay focused while sitting and looking at a computer hour after hour. So we took frequent breaks and tried to play with camera at all breaks for practice.

After lunch we cover the CD-ROMs, including spending over an hour on the suicide CD. It is very powerful and they felt it was useful.

In afternoon, we work more on putting the elements together for a full case, then practice an actual case over and over again. This time we are aware of the bugs and it goes fairly well. Because we had clinical coverage, it was not easy for me to note how well they used the CHAM so we discussed it a lot. Looked at PPT presentation and made regular references to it. They could tell me what the CHAM said about things and I had to use that on skills list.



Evening is very busy for the clinic again. Patients and family there until about 9:00 PM. I learn much about life up here from locals.

There is running water into the clinic, but no plumbing out. A lady comes several times a day and empties the honey bucket. Polar bear warning still airs on local channel.

Saturday – 1/30/99

Travel: Kivalina to Point Hope to Kotzebue to Anchorage

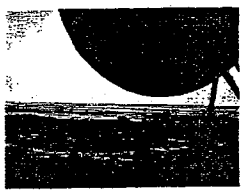
Activities:

Morning class included repetition of whole process, answering any last questions and discussing more big-picture issues of telemedicine. Trouble shooting elements and also real uses of this technology after the ear project is complete. They say they feel very comfortable with the process and Isabelle says she wants time alone to sit with the workstation and the book (which they all liked very much) and go over it again by herself. This is another very good group to start with. Etta has the strongest computer skills with Myra at a second. Isabelle is very enthusiastic and senior in clinical skills. They all want telemedicine and are very willing to work for it.

I stress Denise's message about calling for anything they believe they might need to be successful; more training, help desk, cookies, anything! They clearly appreciate this.

By noon I start on finishing the workstation configuration, putting the drawer on (except back screw on CPU side), cleaning up numerous boxes of network stuff (from Eugene's guys) and putting food away for them. Try and leave the place as clean as I found it.

First couple planes are cancelled, too cold. Finally a 3:40 PM flight on Bering is expected to land. I take a few pictures around the community, but it is very cold. Can only expose skin for a few seconds before damaging myself.



Note that satellite dishes are pointed almost downward, towards the horizon.

Home to Anchorage by 9:30 PM.

#2, Notes for Stewart & Denise

FYI, to avoid confusion with who to send things to, I'll just send it to both of you. You can consider it and divide it up as needed.

1. First (bottom line): THE **EQUIPMENT IS GREAT AND THE CHA/PS AND PATIENTS LOVE IT.**
   Just today I saw, with the CHA/Ps, 4 kids who the CHA/Ps felt had "red eardrums" (i.e. they would have treated them for otitis media). Only ONE of them had a bulging TM with poor mobility when we looked together with the Telemedicine otoscope, so we saved three of them being put on unnecessary antibiotics.
   - I shared that info. with Ken Petersen.
   - Ken feels because of the CHA/Ps' focus on "red" TMs (which, remember, he says should basically NOT be considered), that we should continue to hit the criteria for assessment of AOM when teaching CHA/Ps.

2. **RE: Organization of the Materials in the Villages.** See my note to Eugene regarding entitled *Organization of Computer Materials in Each Clinic, including* "CHA/Ps need a case to protect their CDs and a case to protect their floppy disks." I sent a copy of that to you. Maybe you can tell that by the time I finished up that note to him I was pretty frustrated by the MESS that I found.

   You'll notice, though, that the appearance of the telemedicine cart is GREAT. It makes me feel good to look at it. And looking at it helps me to keep working on organizing the rest of what is there, which is NOT nice.

   Maybe you'll want to help Eugene with the organizing. My feeling/suggestion: At least the *Telemedicine part* should be well set up and organized as a good model. We can't control the rest of their department's organization, but I think we owe it to this project to see that things are well labeled and organized, including in the pull out drawer.

   See my document labeled "RE Signs...." It is updated and includes my latest drafts of signs/labels PLUS pictures of how I set it up in the Shungnak Clinic. I'm sending it to you again now.

3. **Denise, please share my information** (however you decide to change/modify it). For example: Please share with Reggie Kuhnley. I guess I got a call from Reggie on my home phone. I haven't returned her call. She wondered if I had some teaching ideas to share with her. I certainly do, but they are mainly all in the materials that I have been sending to you. Can you share with her the information that I've been sending? My thoughts are that she (AND OTHERS) can use much of it (like some information in this letter and info in the "Signs" document, mentioned above) and can print it out on the village clinic computer, helping to organize things.

4. **Denise, I recommend that village Telemedicine trainers highlight some computer keys** (with different colors), to help CHA/Ps who rarely use the computer or rarely type.
   - Use Permanent Ink Markers.
   - Highlight most of the key, but leave the center (name) uncolored, so it's easier to see.
   - Mainly highlight these keys:
     - Control
     - Alt
     - Delete
     - Enter
     - Page Up
     - Page Down
     - ↓ button

5. **Stewart, some additional things that I think need to be written up, telling CHA/Ps *"How To"*:**
   - Write up: How to Delete folders from the various telemedicine menus.
   - A reminder. Also needs to be written up (I might get the chance to do it while in Ambler):
     How to deal with the telemedicine computer program not accepting doing the Still Images first and NEXT the Smart Form. You'll remember, Stewart, when we talked about that that I told you MOST of the time for EAR problems the assessment isn't finalized until the ear exam is finished (until after telemedicine otoscope has been used).
     What I have found that works: When the computer won't bring up the Smart Form (it beeps): Close the window (X). Re-open it from the Draft folder, and it'll work.
     Now it's easy to say it this way in a few words, but I can tell you from working out here that it needs to be spelled out clearly, correctly, and in detail for a number of folks.

6. **Stewart, I recommend creating some "macros" (short cut keys) for typing common words, if at all possible** (e.g. CHA/P presses alt+R to type "RIGHT EAR"). Such short-cut keys will help folks who are not good at typing. Note that I already tried to do this.
   - Took me a good hour or so to find out that:
     - I could create a macro in WORD but it wouldn't work in the "Outlook" program.
     - I couldn't create a macro in the Outlook program.
   - At this point (you may get more recommendations from me/others if Macros are possible), I recommend the following Macros:
     - RIGHT EAR
     - LEFT EAR
     - SEE PEF (patient encounter form), faxed to hospital.
     - NO PEF (patient encounter form) was faxed to hospital. Patient was treated using MSO (medical standing orders). If not enough information is included here, please ask me to fax the PEF.

7. **A repeat message**, for emphasis; I mentioned the concepts in a previous note: I hope (?new software?) that one of the ways CHA/Ps can organize their list of files (?which will probably be kept in the "Sent Files" area?) is by patient's name. That is going to be an important way to find patients' files, when wishing to compare different exams between different clinic visits.

I guess that's about all I can put out for today. Hope it's helpful.

Your guy in Shungnak (till noon 2/2, and then I'm off to Ambler),

Rob

Some Additional Tips/Advice

For Alaska Telemedicine Testbed Project

--Suggested by Rob Burgess, M.D.

When you turn the computer on

We've had some trouble with the monitor (screen) NOT coming on. It stays black

1. Be a little patient. It takes a while to start up.
2. *If it IS working right*, you'll have a few signs:
   - The light for the computer screen (monitor), and the lower L side of the monitor will quickly come-on green, then go to red, then (1-2 min.) *should go* back to green. *If it stays on red*, chances are it's not going to work right
   - The lights on the little box pasted on the R hand lower corner of the monitor should light up once or twice.
   - You should hear an occasional beep from the computer.
   - You should hear other computer-type noises that tell you it's doing something.

3. OK, you've decided that it is NOT working right. The screen stays black for a couple of minutes. Try these things:
   - Turn off the power (main switch). Wait 1-2 minutes. Turn it on again (and say a little prayer of your choosing).
4. If Number 2 above still doesn't work,
   - Repeat #3 above, PLUS:
   - While the computer is turned off, locate the black plug at the top of the back of the COMPUTER (NOT the black box where you press the main on-off switch on, but the tall, tan-colored main computer. It is located on the bottom L of the cart). UNPLUG and REPLUG that top, BLACK plug on the backside of the computer).
5. Still no work?
   - Repeat #3 again, once or twice..
6. Still no work?
   - Call your telemedicine folks for advice.

STEWART/DENISE: The NEXT page ("Digital Camera") is the only paage from this document that I have actually given to the CHA/Ps so far (to put into their notebooks). The rest of this stuff is in draft form. Initially I thought I might finish it, but I've gotten frustrated with it and have stopped working on it since you may decide not to use it at all (as I mentioned in my "Notes toStewart Ferguson" letter).

Digital Camera.

In the *White Notebook* (Telemedicine Workstation reference), there is a limited amount of information that you can use to get started correctly. Also do the following:

- **Locate, read, and store the additional information:**
  - Locate the booklet and other papers that came with your digital camera.
  - Read over these materials. They will help you to understand your camera better.
  - Place those reference materials nearby in a safe spot *where you and others can find them easily* when you need more information.
- **Ask your referral hospital how to get replacement batteries:**
  - the regular battery, described in your White Notebook
  - and the Lithium battery, described in the booklet that came with your camera..

To copy an E-Mail Folder from a Telemedicine E-Mail List to Another File in Your Computer:

1. From the list, highlight (click on) the E-Mail Folder that you want to copy.

2. Click on *File* (upper Left).

3. From the File Menu, select (click on) *Save As*

4. After the next small box appears (title at top is *Save As*), do the following:

   - Look at the "File Name" near the bottom of that small box. Change the name if needed.

   - Look at the "Save as Type" at the very bottom of that small box. *In order to save any pictures correctly, it must say Outlook Template.*

     If it does NOT say Outlook Template, click on the ▾ button to the right of the name, and select *Outlook Template.*

   - Next, look at the "Save in" information, near the top of that small box. *Be sure that where you want to put a copy of the the E-Mail folder is the file name that is listed (e.g. "Personal" or "My Documents").*
     If the name of the folder is NOT correct, click on the ▾ button to the right of the name, and continue double clicking on folders until you select the correct folder.

   - Finally, click the *Save* button, on the Right of that small box.

5. Check to see if the E-Mail folder copied correctly: Go to that location, and open the copied file.

to be sure that the E-Mail

Doing a Consult

Stewart, this is one of the things that I haven't had time to work on. The following is advice Carrie sent to me, regarding how to do a Consult (e.g. when CHA/P wants to send a consult message back to the doctor, to another CHA/P, or whatever).

If your software changes are at all delayed in coming, something will need to be written like Carrie wrote for me:
(Again, the following message was to me from Carrie):

.after you read the mail, keep the Smart Form on the screen and select 'Forward' on the top of the screen
when the template for the forwarded message appears, it looks like the same Smart Form, ONLY IT HAS A BOX LABELLED 'ADD CONSULT' ABOVE THE WHITE COLUMN WHERE 'PATIENT' AND 'PROVIDER' ARE LISTED NEXT TO THE SCREENS.
Select 'add consult' and the consult #1 screen appears - fill it in - make sure you indicate in the 'TO' box the address of where you want to send it, and hit 'SEND' (also, there's a box at the bottom that says 'add consult' and one that says 'delete consult' - by selecting 'add consult', this may also send it - I haven't tried this option,yet, but you may want to and let me know how this works -

02/02/99

Notes for Eugene Smith:

Dear Eugene:

As folks continue to use the telemedicine and computer equipment, I imagine you'll be doing lots of "fine tuning" and planning/organizing.

While I am helping to teach CHA/Ps how to use your telemedicine equipment, I am keeping track of and writing-down related comments/suggestions/questions, to help with the Maniilaq project.

Although I have been sending most of my suggestions to Stewart Ferguson at ANHB (he may forward some things to you), I have a few comments that I thought should be sent directly to you. I hope the information below is helpful.

FYI, should you want to respond to me, current plans are for me to

- Leave Shungnak at mid-day on Tuesday 2/2 and fly to Ambler.
- Teach in Ambler until I leave at mid-day on Friday, 2/5.

--Rob Burgess

1. **Organization of Computer Materials in Each Clinic:**
   Although the Telemedicine Cart in both villages looked very neat and well organized, in both villages I found installation disks and CDs left at various places around the clinics.

   CHA/Ps need a case to protect their CDs and a case to protect their floppy disks. For example, there is a bunch of CDs that came with the computer (e.g. *Restore System*, *Software for Printer*, etc.). None of these are in protective plastic disk boxes. They need to be protected.

   For now, I'll put them together in a box of some kind, but I recommend sending out at least one good sized floppy disk storage box and one good sized CD storage box.

   In fact, since I first started to write this to you, I have spent many hours trying to sort out/organize/label what is there. (You may see from the time of day when this is sent to you, that I'm spending long hours on it.) I found information about the two computers mixed up together, information left about Windows 95 (?not being used here anymore?), and really, just a mess of jumbled materials. It hurt me to see expensive CD programs lying loose in the drawers along with snacks, pens, and paper clips. It's not the Health Aides' fault; they'd received next to no orientation.

2. **New telephones:** As you tell folks how to use their new phones, I suggest you include the following subjects:

   - Answering Machine Button. I guess the phones arrived with the answering machine button turned on (at least in both Kobuk and Shungnak). Sante realized that it was turned on in Kobuk, but the one in Shungnak was left on (I turned it off). *If it's on,* calls are answered after two rings and callers are told to leave a message, but there's no tape inside on which to leave a message.

   - The message "This party does not accept blocked calls." Since you are encouraging CHA/Ps to use the new phone for long distance calls (dialing 9, through Kotz, etc.), they are going to run into this message more and more. You should tell them how to disable the call block, at least for individual calls.

     Incidentally, I tried using *82, which is the code that we use in Anchorage to disable call blocking for a single call. I couldn't get that code to work, no matter where I tried to insert it (before or after the 9, the 1, the area code, etc).

I guess that's about it for now. I can imagine how you feel with a huge project like this going on. I hope some of these comments/suggestions can help to give you ideas toward how to organize.

-- Rob Burgess, M.D. (helping out teaching for the Telemedicine Project)

Hi Denise. Some notes:

1. **Mainly:** See the copy I sent to you of my mail to Stewart, with the attached letter entitled *Notes for Stewart Ferguson.* You'll probably want to know about those notes AND you'll probably have some thoughts about them. Maybe I'll have more *specifically* for you as I find more time. Right now, I've worked on telemed stuff (and practicing on the computer with it all) for most of the weekend. Time for bed.

2. CHA/Ps know that you are sending them new consent forms. In the meantime, they are copying and using the copy of the new consent form, found in the White Notebook.

3. I think your estimation of time needed was accurate...because of normal village delays, because of the need for individual teaching, etc.

4. I didn't get your return Email commenting on my CHAM-error reflection. How you got my original: I sent a copy of it to Carrie. She forwarded it on to you, thinking you might get it more quickly. When you sent the reply, it went to Carrie, who deleted it. Oh well. If you still have a copy of it on your computer, send it to me again. If not, I DO appreciate the thought.

Thanks,
Rob

Telemedicine Shungnak

om:	Telemedicine Shungnak
Sent:	Sunday, January 31, 1999 12:49 PM
To:	'Denise Statz, Telemedicine Project'
Cc:	Telemedicine Buckland; 'Stewart Ferguson, ANHB Telemed Project Systems Analyist'; Telemedicine Shungnak
Subject:	Signs to put onto the telemedicine computer

I am attaching a WORD 97 document that I just made up. I hope it *pulls up* for you, and I assume it should.
It is: a couple of signs for the computer.

The top label on the document just says
This is the telemedicine computer.
The label is small enough so it can be cut out and taped onto the top area of the keyboard.
The letters of *telemedicine* are all small case and larger than the rest, indicating the CHA/Ps' password.

For CHA/Ps who don't type much and don't know where the keys are the letters are color coded.
Left (Left hand or Left Side of Keyboard) = Lavender color (well, *kind* of Lavender in color and still contrasting with the other color)
Right (Right hand or Right Side of Keyboard) = Red color

the other label can be cut out and taped onto the top of the screen area. It reminds folks that the omputer is for telemedicine use. I believe you wanted people to mainly use the computer for telemedicine stuff?

If folks are using these labels (I'm sending a copy of this to Carrie for her & the Buckland CHA/Ps to *consider* using), then I recommend (until the labels can be "laminated") that the labels be taped on in such a way that tape covers all of the printing (so the label/sign doesn't get wet and make all of us look so horribly bad, causing us to rush for the Suicide Prevention CD whether or not we've installed Quick Time). Hee hee.

Take care--Rob

Signs.doc

7.63

Telemedicine Shungnak

From: Telemedicine Shungnak
Sent: Saturday, January 30, 1999 3:56 PM
To: 'Denise Statz, Telemedicine Project'
Cc: Telemedicine Buckland
Subject: Larger Tubing Needed

Hi Denise.
I thought I'd enclose a picture in this message. Because of that, MAYBE you won't be able to read it as easily, so I won't add a bunch of other information/questions in here. Otherwise, normally, I imagine I'll send you an E-mail with *various* messages/comments/suggestions included when I write.

Folks could use larger tubing than the tubing that you sent..

You might ask Jean Rounds Riley for specific information. I know that they have the correct kind at ANC-CHAP. She may be able to get you more specific information for ordering as well.

The tubing that you sent is very THIN; and so in order to add enough onto an ear speculum, for most patients, you need two or three layers of that thin tubing. It's kind of hard to stretch it over itself to make those layers. A thicker tubing would be much better.

Take a look (if you can) at the (attached) digital picture, which should show you the difference pretty well. The thicker tubing is on the Right. You'll see that I just have one precious piece (which I took from Kobuk). which they will plan to use and re-use (cleaning with an alcohol wipe). I'm also taking along a little "starter" piece to Ambler. So, No hurry. Regular ordering and mailing should be fine, but I assume that your office would want to send it for now, rather than Maniilaq. (If you disagree, just let Maniilaq know).

Things are going fine. I even had time this morning to watch a little of a Sports Video which Lottie loaned me. That was fun. It isn't every day that you get to see and hear a broadcast of a horse race won by that fast horse *Hoof Hearted* . Announcing: *Hoof Hearted in the Winner's Circle. Hoof Hearted in the Winner's Circle.*
Till next time.
--Rob

MVC-008F.JPG

7.64

Telemedicine Shungnak

om: Telemedicine Shungnak
Sent: Saturday, January 30, 1999 3:56 PM
To: 'Denise Statz, Telemedicine Project'
Cc: Telemedicine Buckland
Subject: Larger Tubing Needed

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Till next time.
--Rob

MVC-008F.JPG

7.65

Dear Stewart:

As you imagined, once we started using the equipment and the telemedicine system, many more questions have arisen. I am keeping track of and writing-down related comments/suggestions/questions, to help you with the Maniilaq project and with the other regions still to be set up. Here's one of my first installments.

In General:

- I imagine that if I send notes to you as e-mail *attachments*, then you can more easily use/edit them as WORD 97 documents? Is that correct? That's what I'll do unless I hear differently from you.
- If you disagree with anything I say in the materials I've made for CHA/Ps (various things; copies sent to you), let me know ASAP.

  Actually (now at 11 p.m. on Sunday night), with my less-than-great knowledge of computers, I'm getting more and more frustrated trying to write-up directions for CHA/Ps. Not that I think you expect me to, but I thought I could do it more quickly than I can. And I can also imagine that what I take hours writing, you may eliminate the need for by changing the software or some such thing..... So, as my available time decreases, I'll probably (more and more) just tell you that something is needed, and let you decide whether/what written directions are necessary.
- The following items are in no special order. I'm just trying to write them down and get them to you. I did do a little RED highlighting to call your attention to things that probably need attention quickly.
- If something I send to you really should go to someone else, just forward the appropriate stuff to the appropriate folks.
- Finally, you may just want to call me to discuss/answer some of this rather than spend lots of time writing back. I plan to be in Shungnak till Tuesday, when I hope to travel to Ambler.

1. **Problem with printing images**...same problem Carrie had, which she told you about (she talked with me on the phone). Note that *before* I showed the Suicide Prevention CD on the computer, I *did* print some of the digital camera and TM pictures. Now I cannot.

   Since I now can't even print images from the disc, I guess that the problem arose from the Suicide Prevention CD? Maybe it's a fault in their software? If so, maybe you could pass that info. on to those folks?

   I know that you're dealing with this and that you'll let us know how to handle it. I imagine you're planning to arrange the system so that smart forms and digital images stay under the initial format even though something else was installed (unless the images are intentionally changed)?

2. **Related to #1?: I can't easily copy an e-mail file to another folder and then bring up an attached picture.** If I try to copy even a *regular* e-mail (i.e. not the telemedicine format), as long as it has a picture in it, it'll only work if I copy it in the "outlook Template" form.

   And *explaining* how to do this copying in the "outlook template" form seems complicated. See my document called Telemed Some Additional Tips.

   Title: To copy an e-mail Folder from a Telemedicine e-mail List to Another File in Your Computer.
   Ugh

   And this has ramifications in regard to CHA/Ps organizing their files (#3, next).

3. **How is the telemedicine information going to be saved/organized in each clinic?** When we had that statewide meeting you mentioned a few things, like files being organized according to patients names, etc. As we add more and more files, I can see that this organization will get more and more important. ← Remind

   - If there is a patient that the CHA/P knows will need follow-up (and the CHA/P will need to refer to previous pictures), should the CHA/P save to a separate folder on the computer, and/or back that folder up onto a floppy disk?
   - Some recommendation should be given in regard to what CHA/Ps should do with "Sent items" and "Deleted items."
   - Don't you think all of this should be worked out (at least in a recommendation form)? Seems like there's a lot more to be done, certainly in terms of organizing and teaching those who'll be using the system.

4. **Regarding Digital Camera:**
   - See the information that I prepared for CHA/Ps in the document called Telemed Some Additional Tips)..
   - I suggest adding such information into the next edition of the *White Notebook,* if possible, including additional more specific information, such as:
     - What should CHA/Ps be advised in regard to having on hand an additional regular battery? AND an additional Lithium Battery?

5. **Telemedicine Admin e-mail address.**
   - FYI, I've gathered the few e-mail comments that I previously sent you c/o this *black hole*☺; they are included in this note.
   - I guess Carrie *also* thought she was sending you things c/o that address.
   - Do you want us to delete that address from the list of addresses? I recommend deleting it; I feel that leaving it there will just lead to recurrent confusion.

   A related question: If CHA/Ps just want to send a message/question to the telemedicine folks at Maniilaq, what should they do //what is the address? c/o

Eugene Smith's e-mail address? Or would that be handled by someone who (I think you mentioned) checks ALL of the telemedicine information when it comes in to Maniilaq?

6. **Regarding <u>regular type e-mail</u> (NOT telemedicine images):**

As I send this, I'm glad that the telemedicine computer can be used to send regular e-mail (without telemedicine forms/images). That ability to send regular e-mail especially makes sense in case the other ("office") computer is down. Nevertheless, it seems that plans are needed for when everything is working fine.

- <u>Has a general recommendation been made as to which computer CHA/Ps should use for different types of e-mail</u> (for example: medical but WITHOUT telemedicine images AND non-medical)?

  If all medical e-mail is sent to the same e-mail address at the Referral Hospital (Kotz), then it probably doesn't matter to the *Referral Hospital* where it is coming from, but it does matter to the village. In the absence of a computer network in each village, <u>I think it will help CHA/Ps' patient care if the following plans are adopted:</u>
  - all medical related e-mail (e.g. questions to the doctors) is kept on the same (telemedicine) computer.
  - Non-medical e-mail is sent on the other (office) computer.

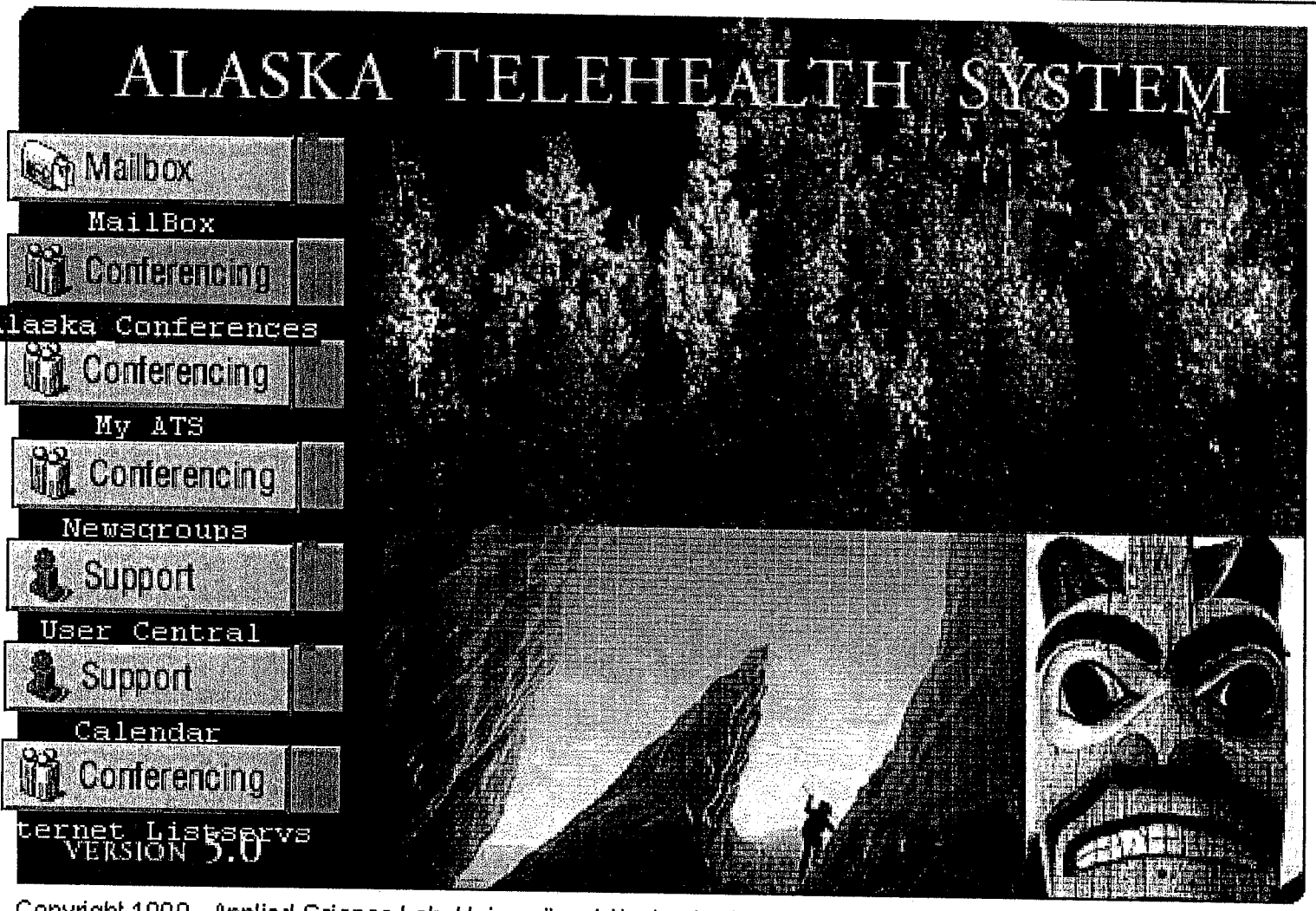
- <u>Is there any way, if we send a medical e-mail message from the telemedicine computer *without* a telemedicine smart form, that the title and who sent it can come up when one looks at the list in the Inbox?</u>

7. **One of my most frustrating problems: Turning on the Machine.** See my document titled Telemed Some Additional Tips, the first section. No, I haven't given that one to CHA/Ps yet, because I think most of it is <u>*my* *hocus pocus*</u>. Maybe Carrie mentioned this one to you already. She had called up Kotzebue, frustrated, and had a conversation with Sante, a rather unsuccessful conversation about what to do.
I'm thinking that the "solution" is mainly to just *gently* turn it on, since it looked like maybe the little button (on the "black box") either got pushed too hard or got stuck.
I really can't figure it out YET, but I'll keep trying, and I would definitely appreciate advice on this if you have it.
(NOTE that I NEVER had trouble starting up the computer in Kobuk, just here in Shungnak. At first I thought it was just THIS computer, until I talked with Carrie and heard that she was having the same problem.)

Desktop

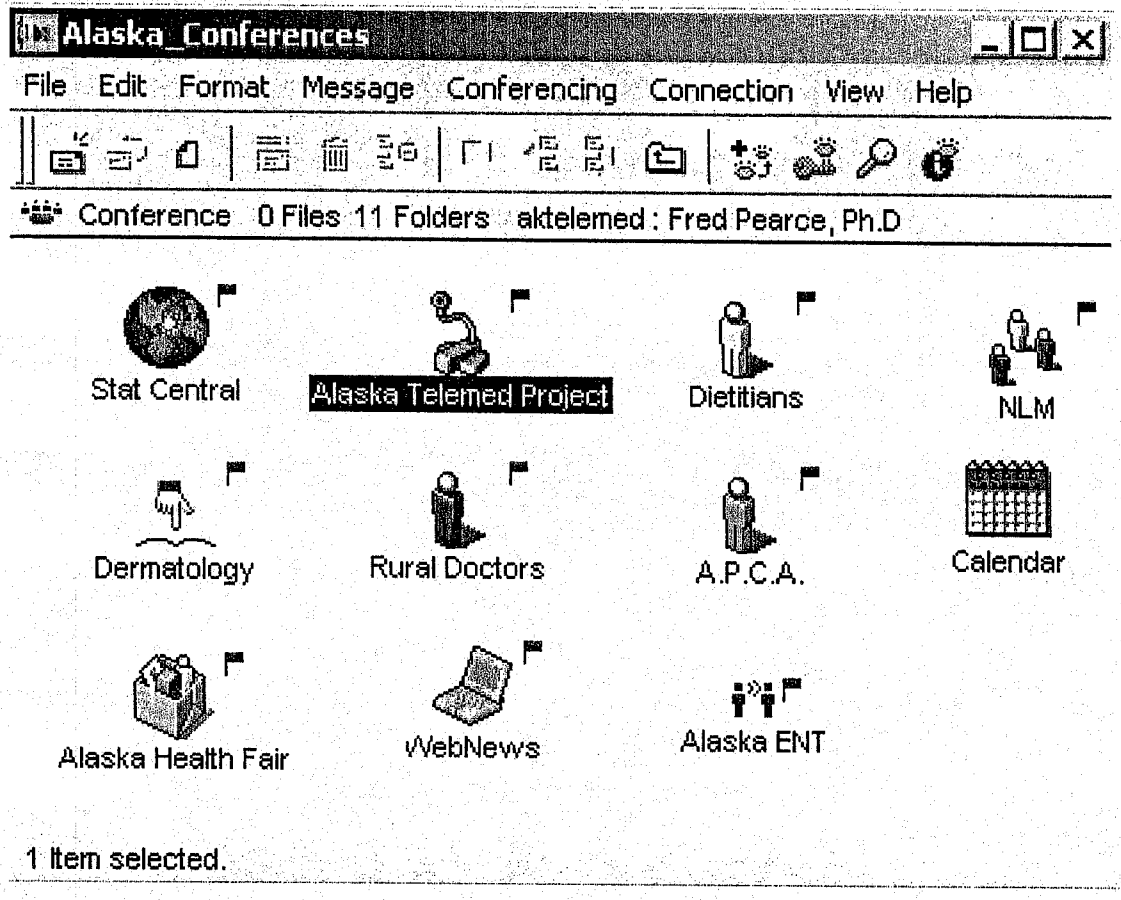
File Edit Format Message Conferencing Connection View Help

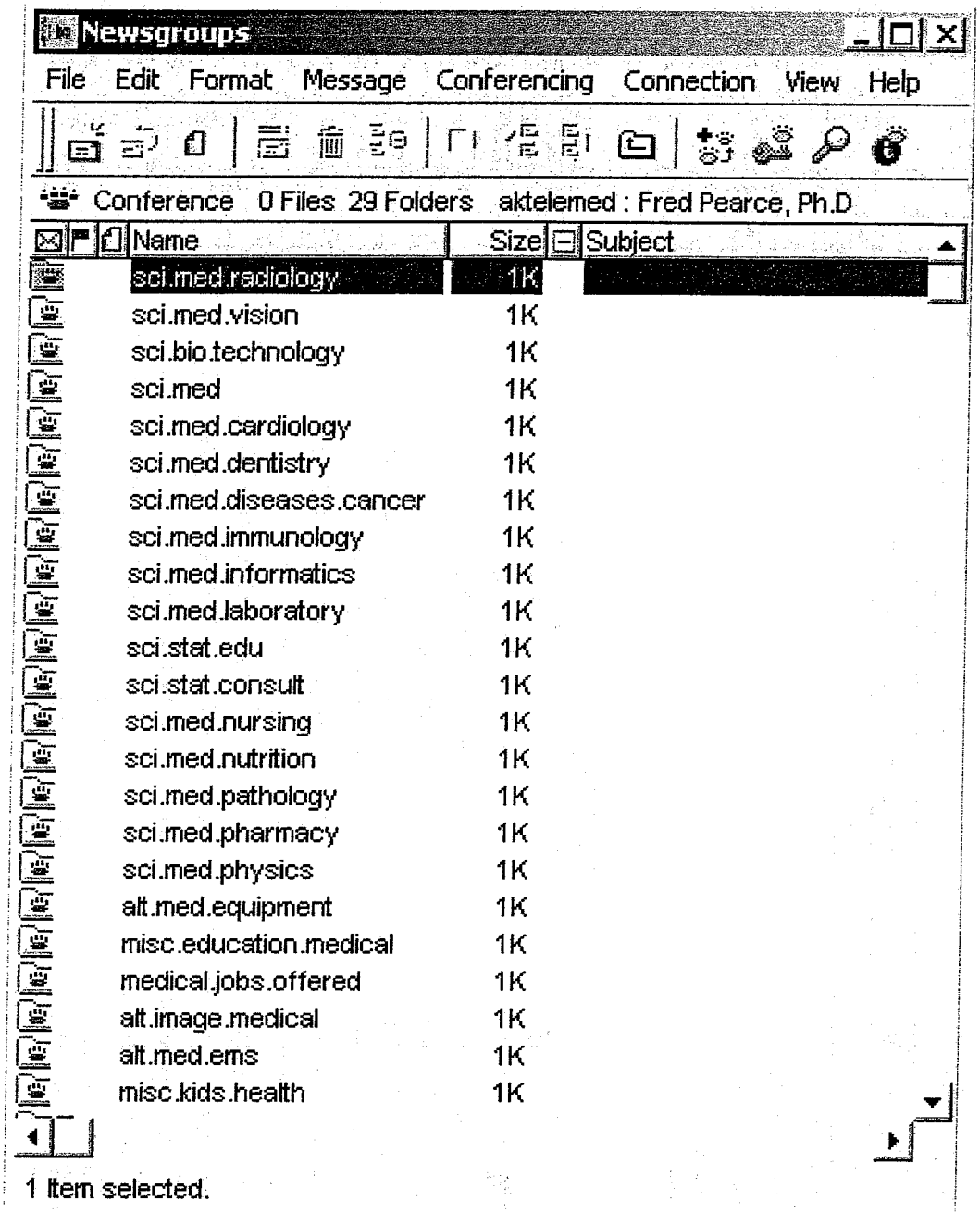
Desktop 0 Files 7 Folders aktelemed : Fred Pearce, Ph.D



Copyright 1999 Applied Science Lab, University of Alaska Anchorage http://www.telemedicine.alaska.edu

1 Item selected.


Alaska_Conferences
File Edit Format Message Conferencing Connection View Help
Conference 0 Files 11 Folders aktelemed : Fred Pearce, Ph.D
Stat Central
Alaska Telemed Project
Dietitians
NLM
Dermatology
Rural Doctors
A.P.C.A.
Calendar
Alaska Health Fair
WebNews
Alaska ENT
1 Item selected.


Newsgroups
File Edit Format Message Conferencing Connection View Help
Conference 0 Files 29 Folders aktelemed : Fred Pearce, Ph.D
Name Size Subject
sci.med.radiology 1K
sci.med.vision 1K
sci.bio.technology 1K
sci.med 1K
sci.med.cardiology 1K
sci.med.dentistry 1K
sci.med.diseases.cancer 1K
sci.med.immunology 1K
sci.med.informatics 1K
sci.med.laboratory 1K
sci.stat.edu 1K
sci.stat.consult 1K
sci.med.nursing 1K
sci.med.nutrition 1K
sci.med.pathology 1K
sci.med.pharmacy 1K
sci.med.physics 1K
alt.med.equipment 1K
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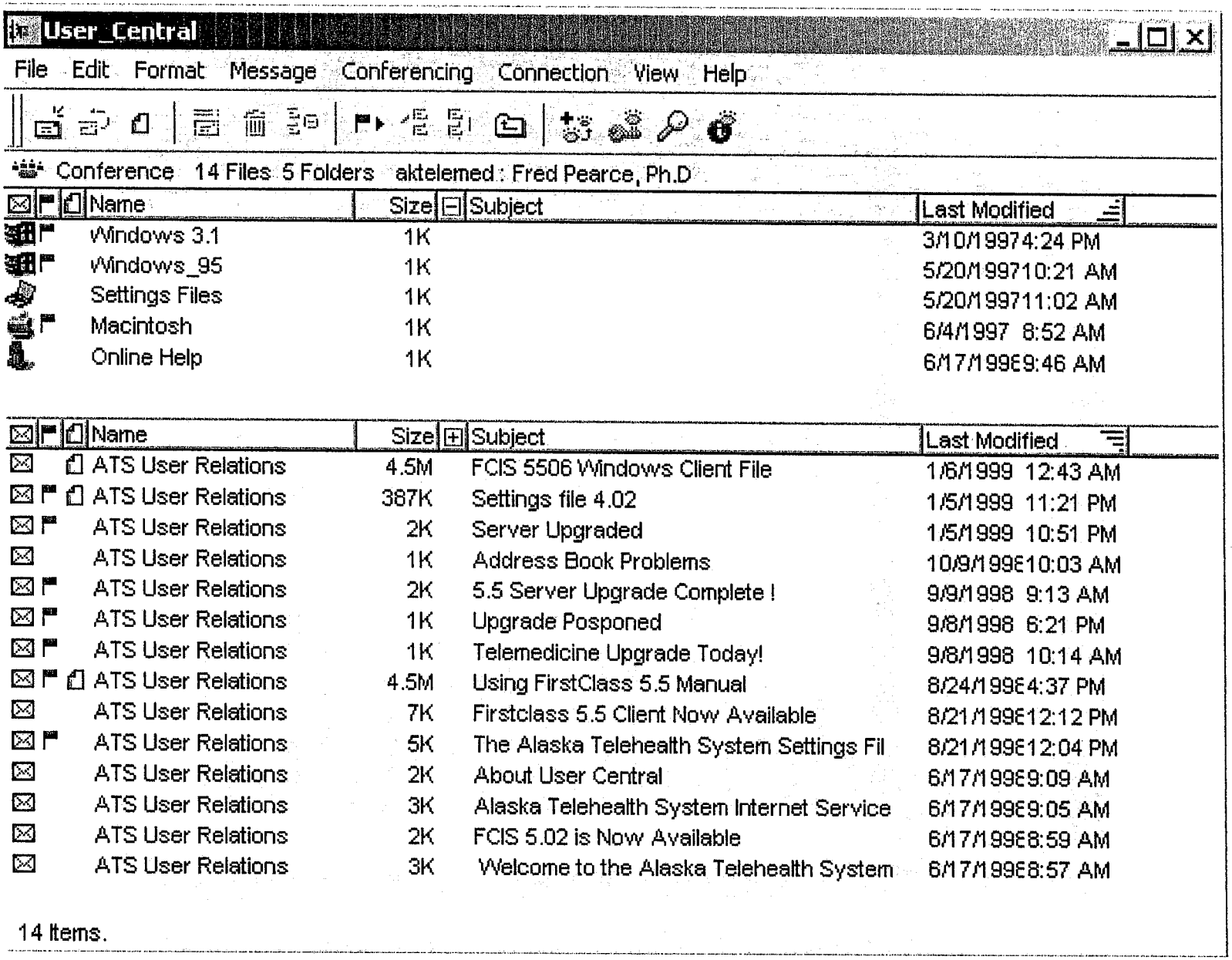
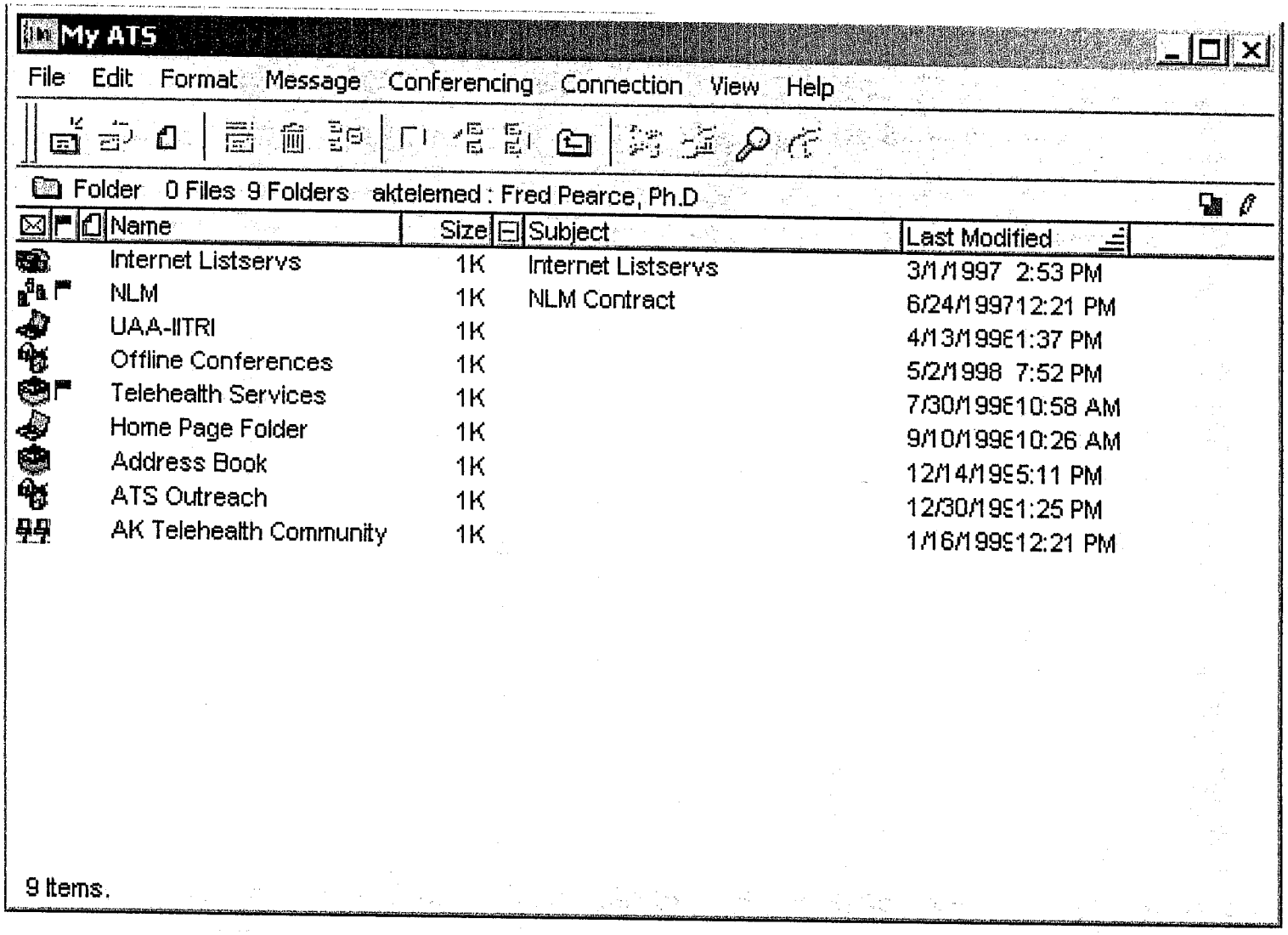
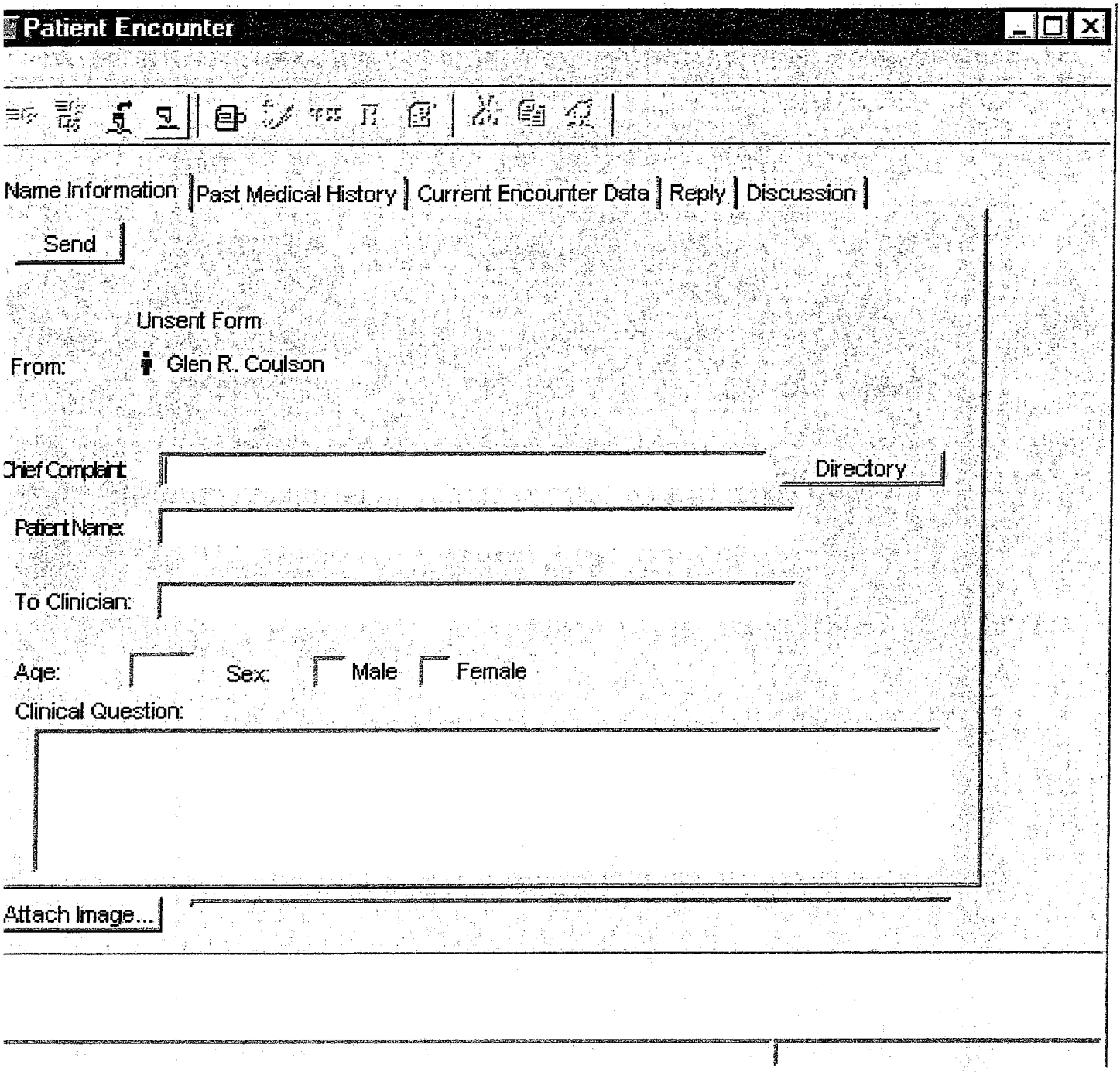
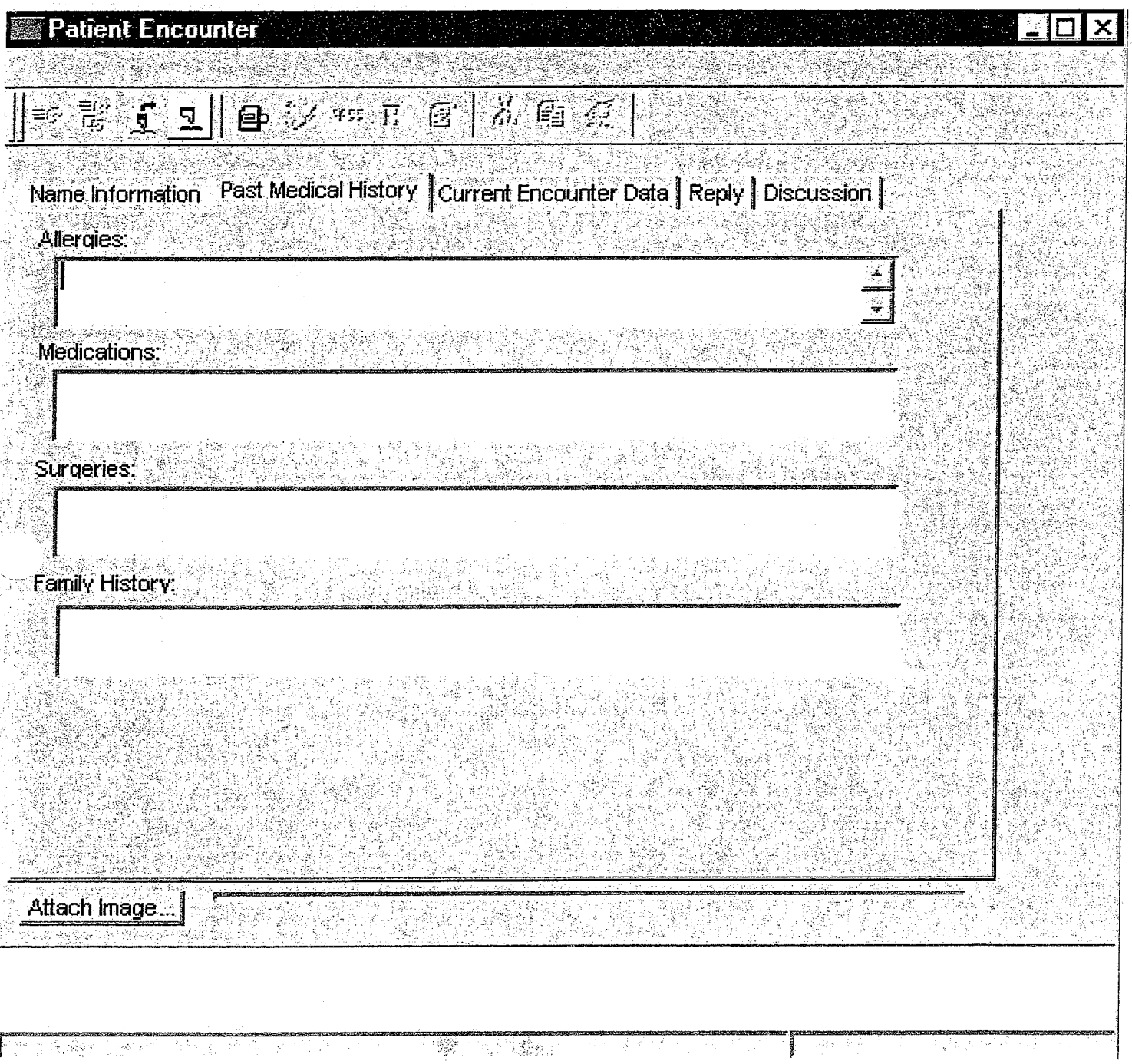
medical.jobs.offered 1K
alt.image.medical 1K
alt.med.ems 1K
misc.kids.health 1K
1 Item selected.

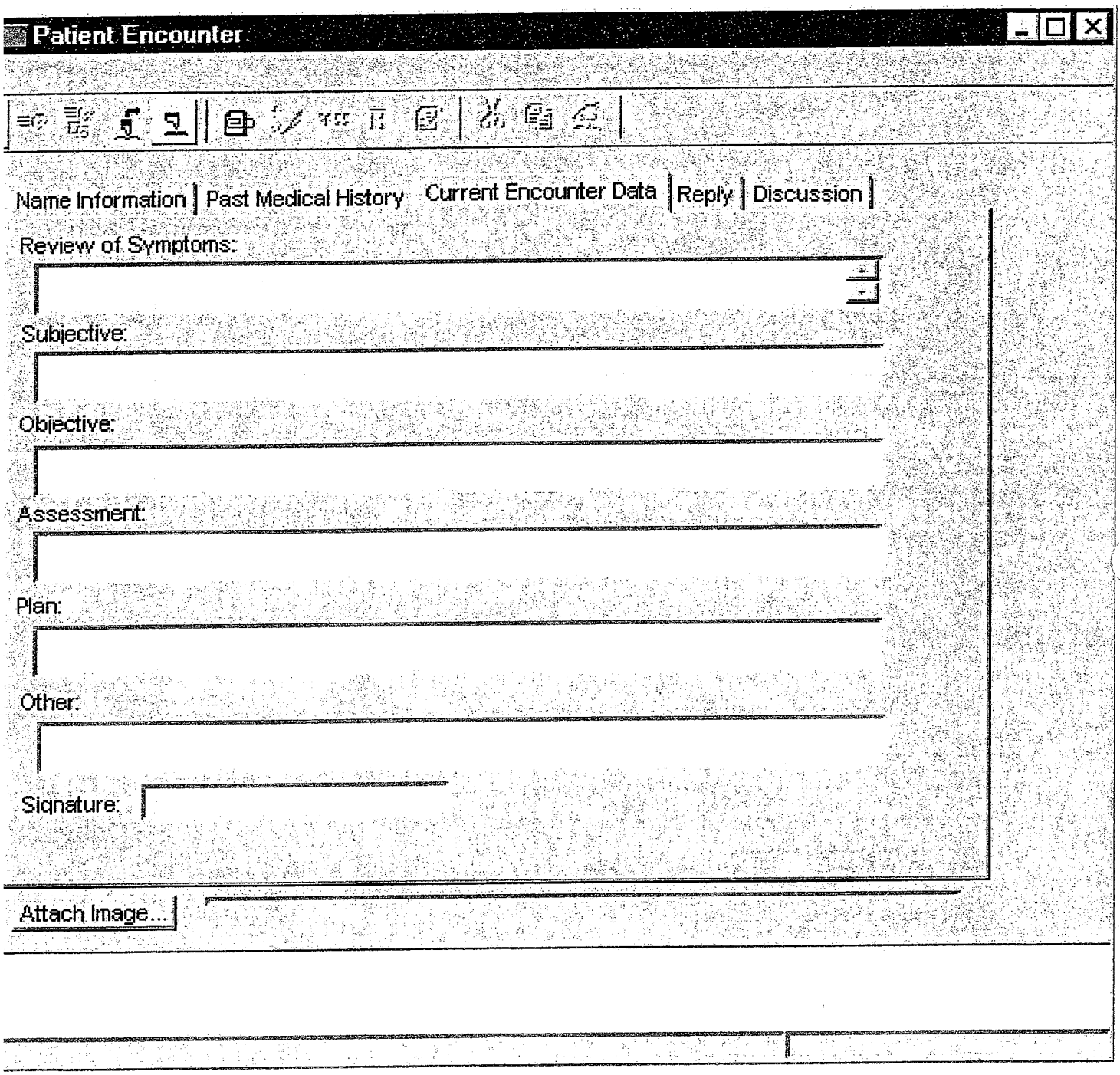

User_Central
File Edit Format Message Conferencing Connection View Help
Conference 14 Files 5 Folders aktelemed : Fred Pearce, Ph.D
Name Size Subject Last Modified
Windows 3.1 1K 3/10/1997 4:24 PM
Windows_95 1K 5/20/1997 10:21 AM
Settings Files 1K 5/20/1997 11:02 AM
Macintosh 1K 6/4/1997 8:52 AM
Online Help 1K 6/17/1997 9:46 AM
Name Size Subject Last Modified
ATS User Relations 4.5M FCIS 5506 Windows Client File 1/6/1999 12:43 AM
ATS User Relations 387K Settings file 4.02 1/5/1999 11:21 PM
ATS User Relations 2K Server Upgraded 1/5/1999 10:51 PM
ATS User Relations 1K Address Book Problems 10/9/1997 10:03 AM
ATS User Relations 2K 5.5 Server Upgrade Complete ! 9/9/1998 9:13 AM
ATS User Relations 1K Upgrade Posponed 9/8/1998 6:21 PM
ATS User Relations 1K Telemedicine Upgrade Today! 9/8/1998 10:14 AM
ATS User Relations 4.5M Using FirstClass 5.5 Manual 8/24/1997 4:37 PM
ATS User Relations 7K Firstclass 5.5 Client Now Available 8/21/1997 12:12 PM
ATS User Relations 5K The Alaska Telehealth System Settings Fil 8/21/1997 12:04 PM
ATS User Relations 2K About User Central 6/17/1997 9:09 AM
ATS User Relations 3K Alaska Telehealth System Internet Service 6/17/1997 9:05 AM
ATS User Relations 2K FCIS 5.02 is Now Available 6/17/1997 8:59 AM
ATS User Relations 3K Welcome to the Alaska Telehealth System 6/17/1997 8:57 AM
14 Items.

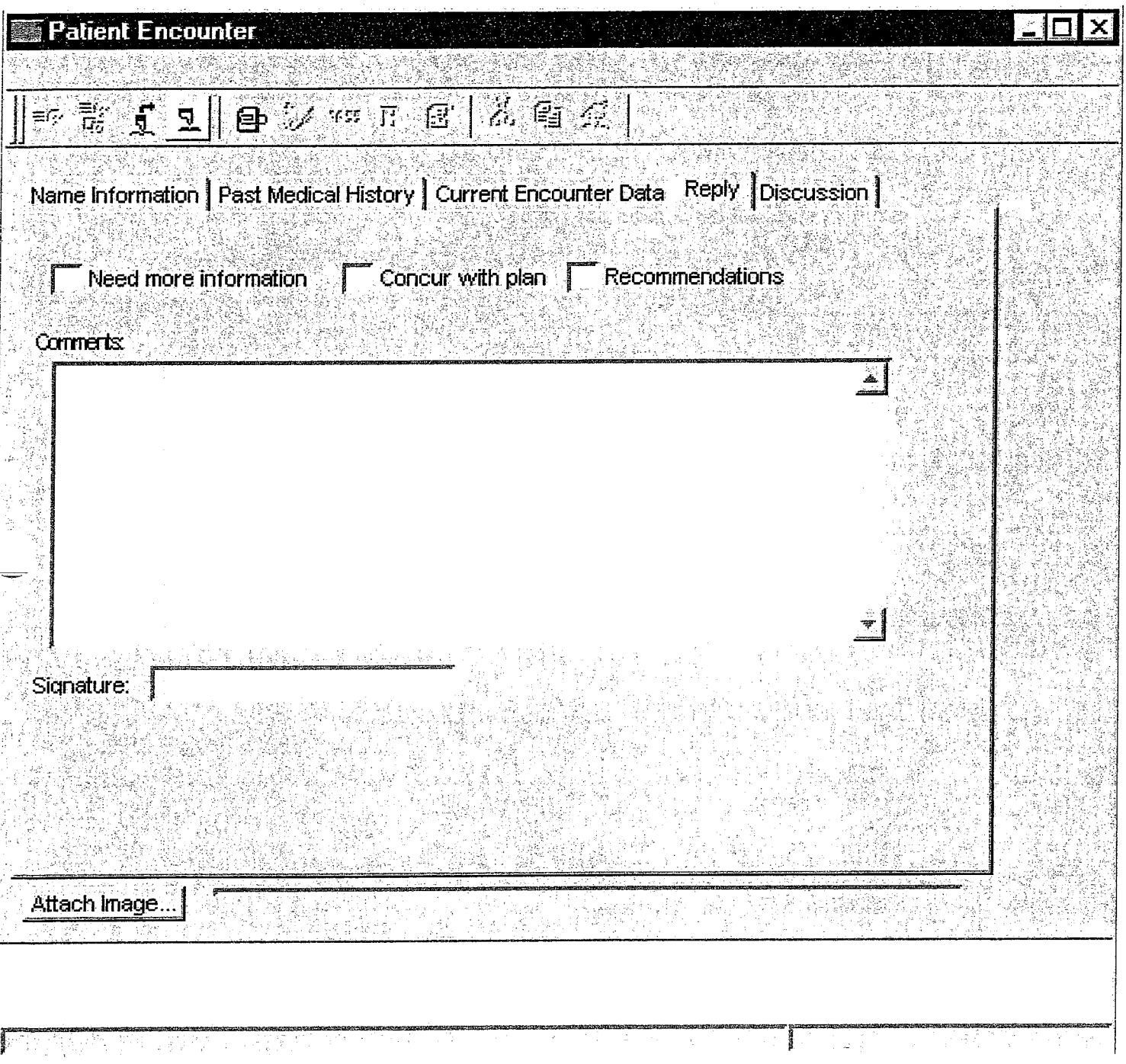
8.4

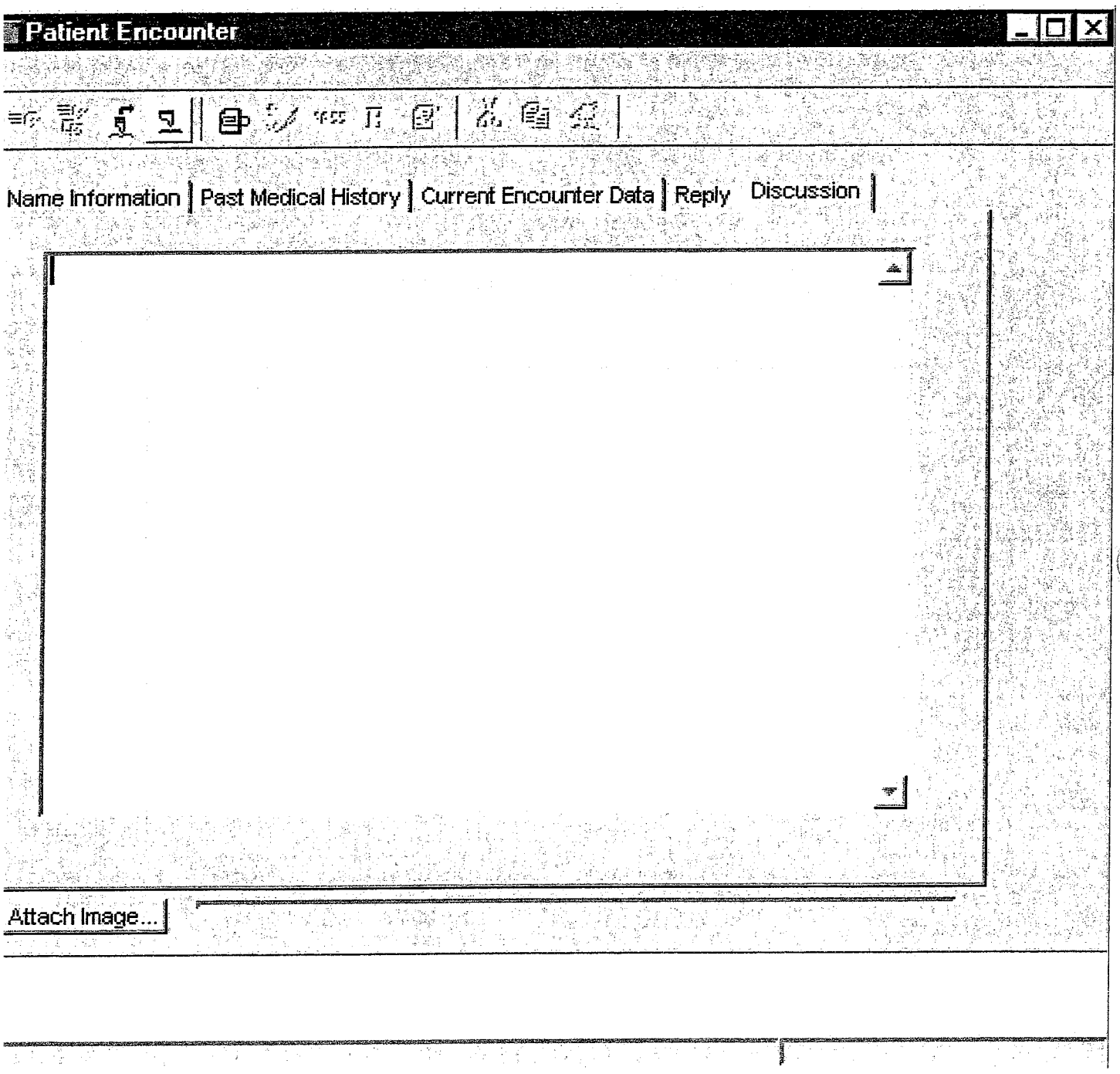

My ATS
File Edit Format Message Conferencing Connection View Help
Folder 0 Files 9 Folders aktelemed : Fred Pearce, Ph.D
Name Size Subject Last Modified
Internet Listservs 1K Internet Listservs 3/1/1997 2:53 PM
NLM 1K NLM Contract 6/24/1997 12:21 PM
UAA-IITRI 1K 4/13/1998 1:37 PM
Offline Conferences 1K 5/2/1998 7:52 PM
Telehealth Services 1K 7/30/1998 10:58 AM
Home Page Folder 1K 9/10/1998 10:26 AM
Address Book 1K 12/14/1995:11 PM
ATS Outreach 1K 12/30/1991:25 PM
AK Telehealth Community 1K 1/16/1998 12:21 PM
9 Items.

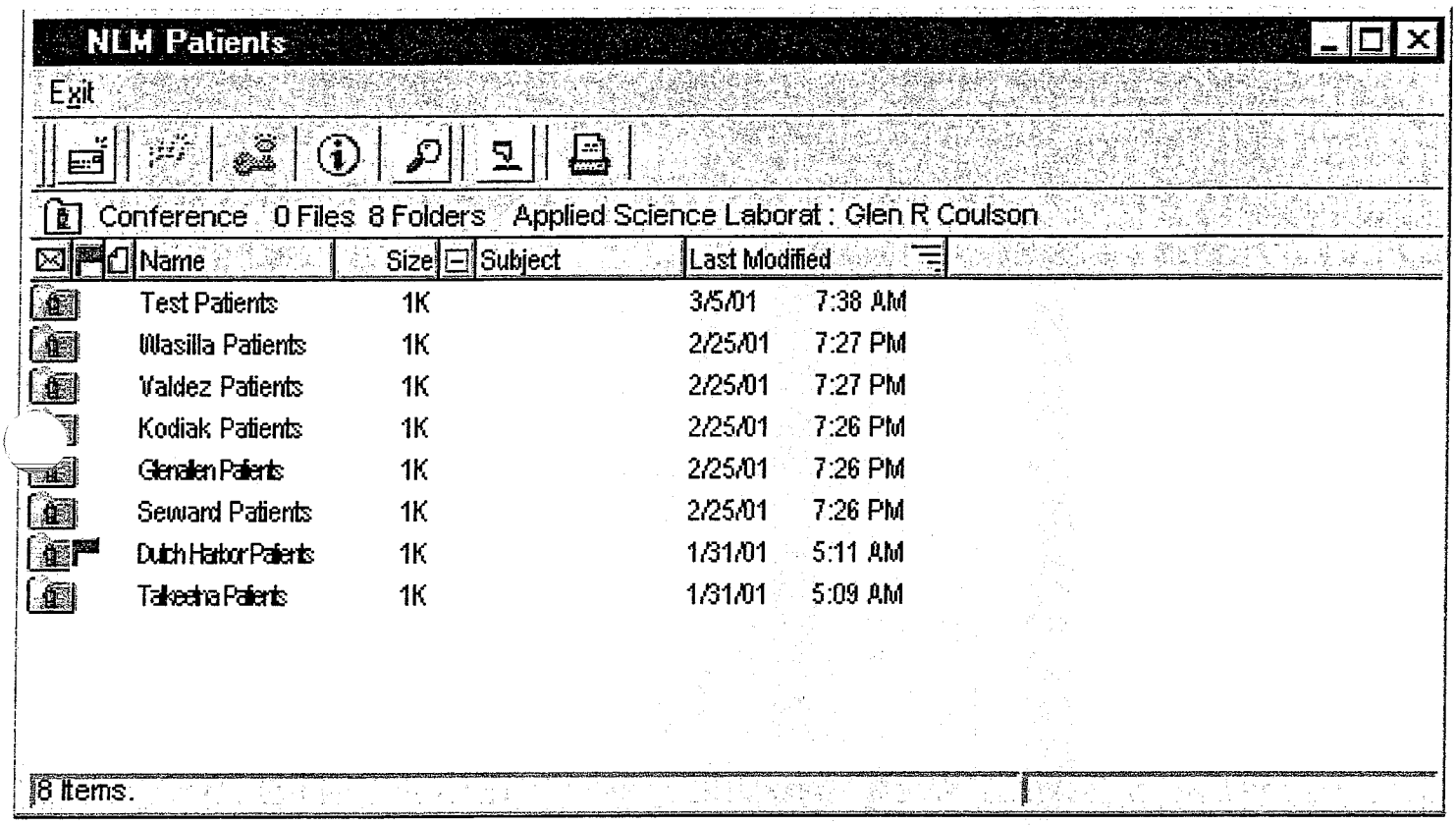

Patient Encounter
Name Information
Past Medical History
Current Encounter Data
Reply
Discussion
Send
Unsent Form
From:
Glen R. Coulson
Chief Complaint:
Directory
Patient Name:
To Clinician:
Age:
Sex:
Male
Female
Clinical Question:
Attach Image...

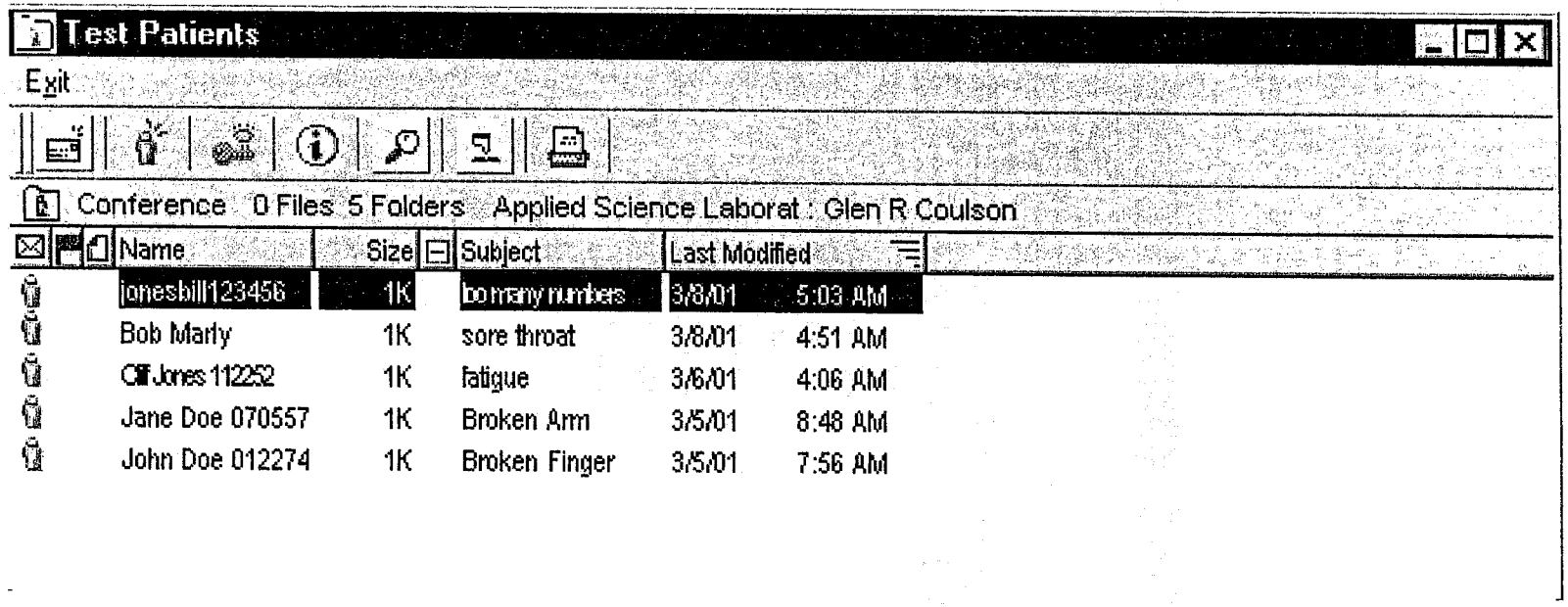

Patient Encounter
Name Information
Past Medical History
Current Encounter Data
Reply
Discussion
Allergies:
Medications:
Surgeries:
Family History:
Attach Image...


Patient Encounter
Name Information
Past Medical History
Current Encounter Data
Reply
Discussion
Review of Symptoms:
Subjective:
Objective:
Assessment:
Plan:
Other:
Signature:
Attach Image...

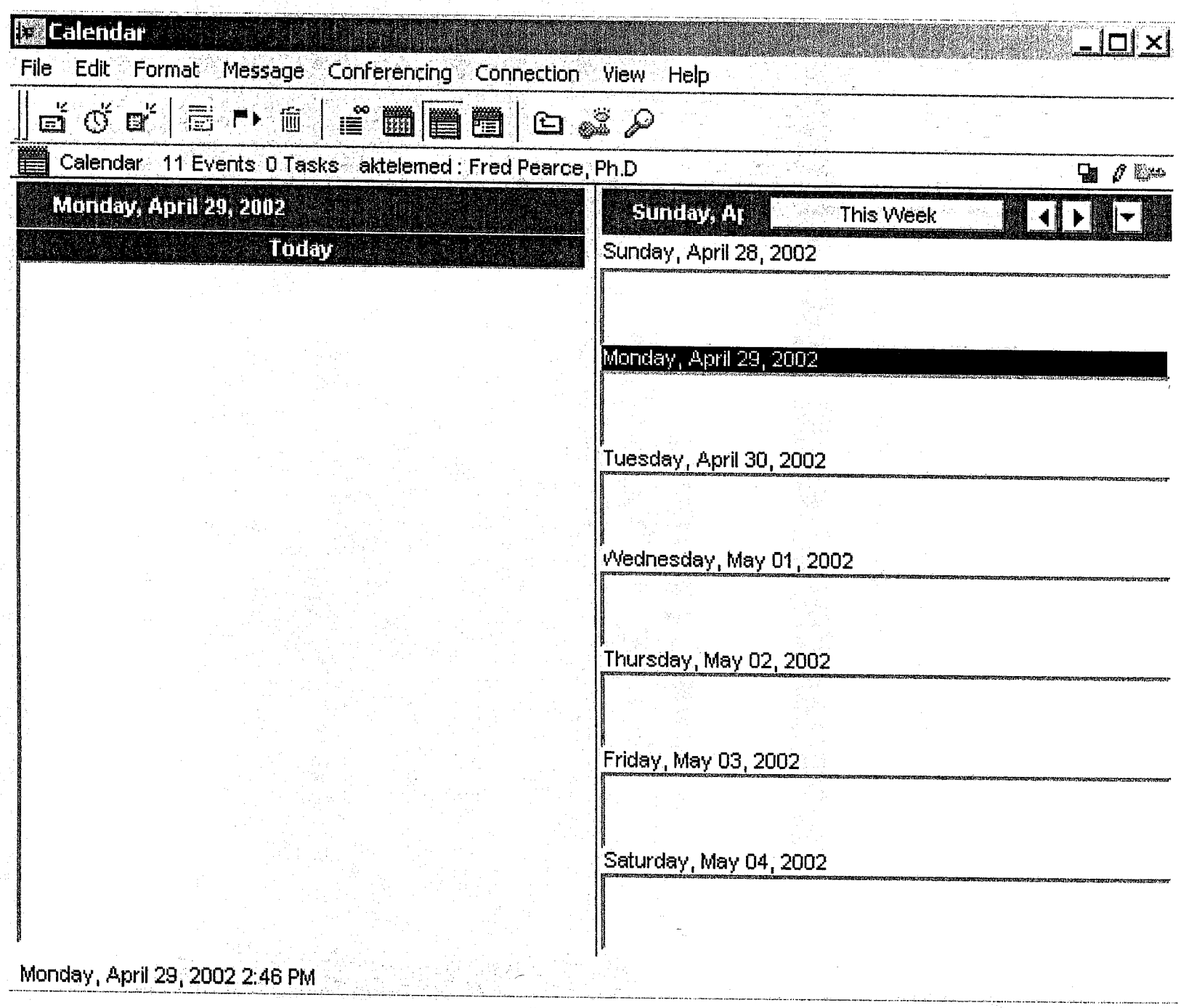

Patient Encounter
Name Information
Past Medical History
Current Encounter Data
Reply
Discussion
Need more information
Concur with plan
Recommendations
Comments:
Signature:
Attach Image...

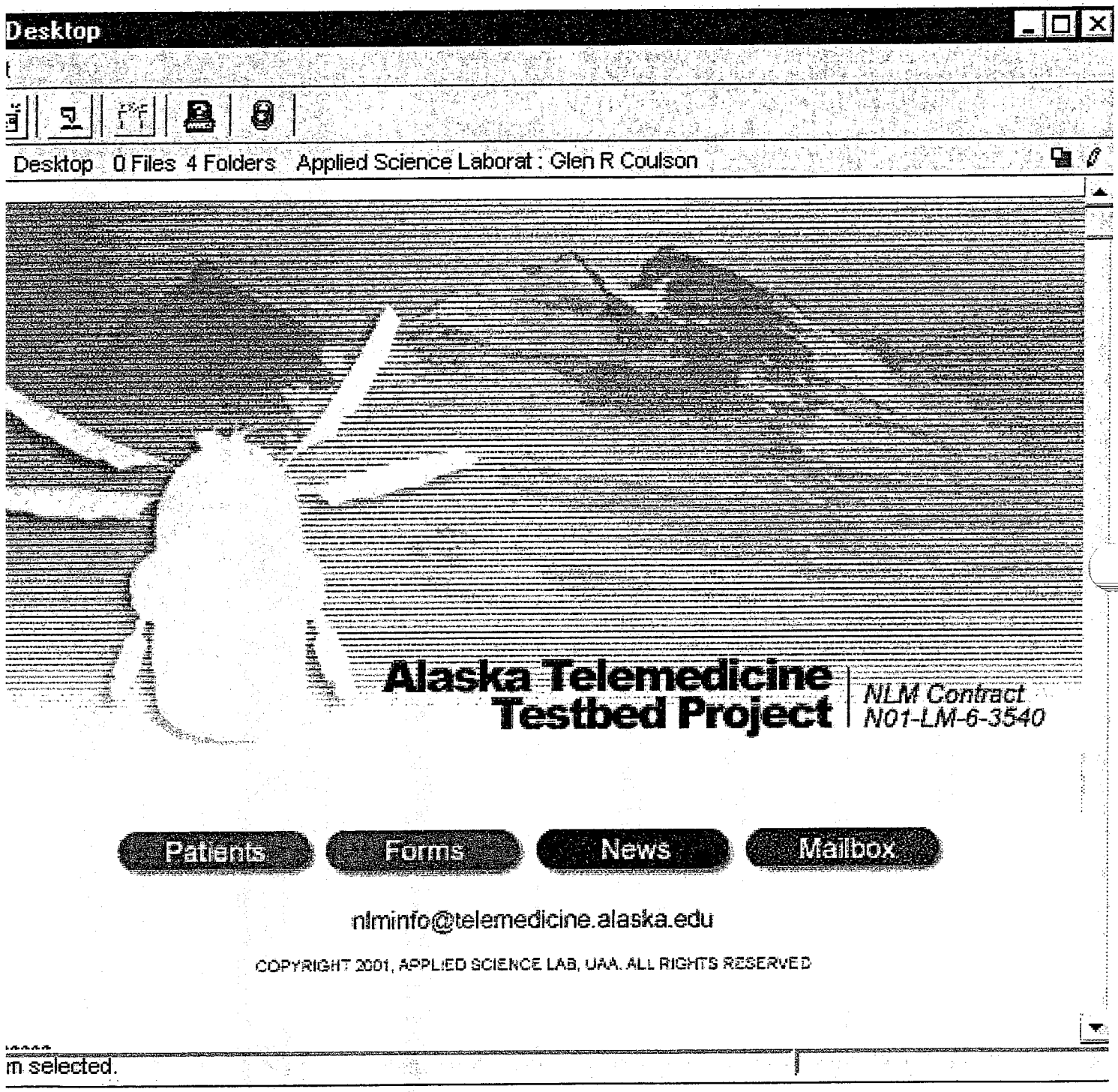

Patient Encounter
Name Information
Past Medical History
Current Encounter Data
Reply
Discussion
Attach Image...


NLM Patients
Exit
Conference 0 Files 8 Folders Applied Science Laborat : Glen R Coulson
Name
Size
Subject
Last Modified
Test Patients 1K 3/5/01 7:38 AM
Wasilla Patients 1K 2/25/01 7:27 PM
Valdez Patients 1K 2/25/01 7:27 PM
Kodiak Patients 1K 2/25/01 7:26 PM
Glenallen Patients 1K 2/25/01 7:26 PM
Seward Patients 1K 2/25/01 7:26 PM
Dutch Harbor Patients 1K 1/31/01 5:11 AM
Talkeetna Patients 1K 1/31/01 5:09 AM
8 Items.


Test Patients
Exit
Conference 0 Files 5 Folders Applied Science Laborat : Glen R Coulson
Name
Size
Subject
Last Modified
jonesbill123456 1K bo many numbers 3/8/01 5:03 AM
Bob Marly 1K sore throat 3/8/01 4:51 AM
Cliff Jones 112252 1K fatigue 3/6/01 4:06 AM
Jane Doe 070557 1K Broken Arm 3/5/01 8:48 AM
John Doe 012274 1K Broken Finger 3/5/01 7:56 AM

8.12


Calendar
File Edit Format Message Conferencing Connection View Help
Calendar 11 Events 0 Tasks aktelemed : Fred Pearce, Ph.D
Monday, April 29, 2002
Today
Sunday, Ap
This Week
Sunday, April 28, 2002
Monday, April 29, 2002
Tuesday, April 30, 2002
Wednesday, May 01, 2002
Thursday, May 02, 2002
Friday, May 03, 2002
Saturday, May 04, 2002
Monday, April 29, 2002 2:46 PM

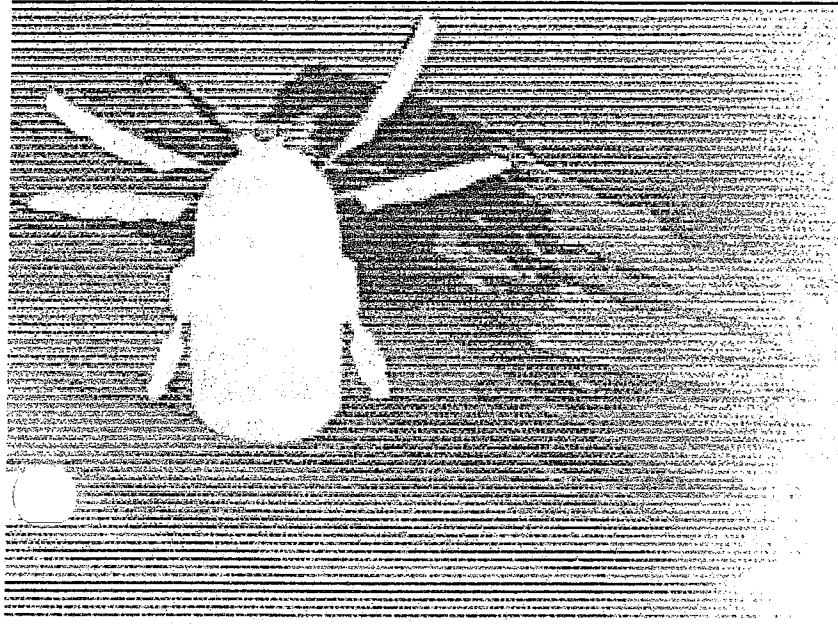

Desktop
Desktop 0 Files 4 Folders Applied Science Laborat : Glen R Coulson
Alaska Telemedicine Testbed Project
NLM Contract N01-LM-6-3540
Patients
Forms
News
Mailbox
nlminfo@telemedicine.alaska.edu
COPYRIGHT 2001, APPLIED SCIENCE LAB, UAA. ALL RIGHTS RESERVED
m selected.

8.14

ATS Forms

Exit

Conference 4 Files 1 Folder Applied Science Laborat : Glen R Coulson



ATS Forms

Patient Encounter

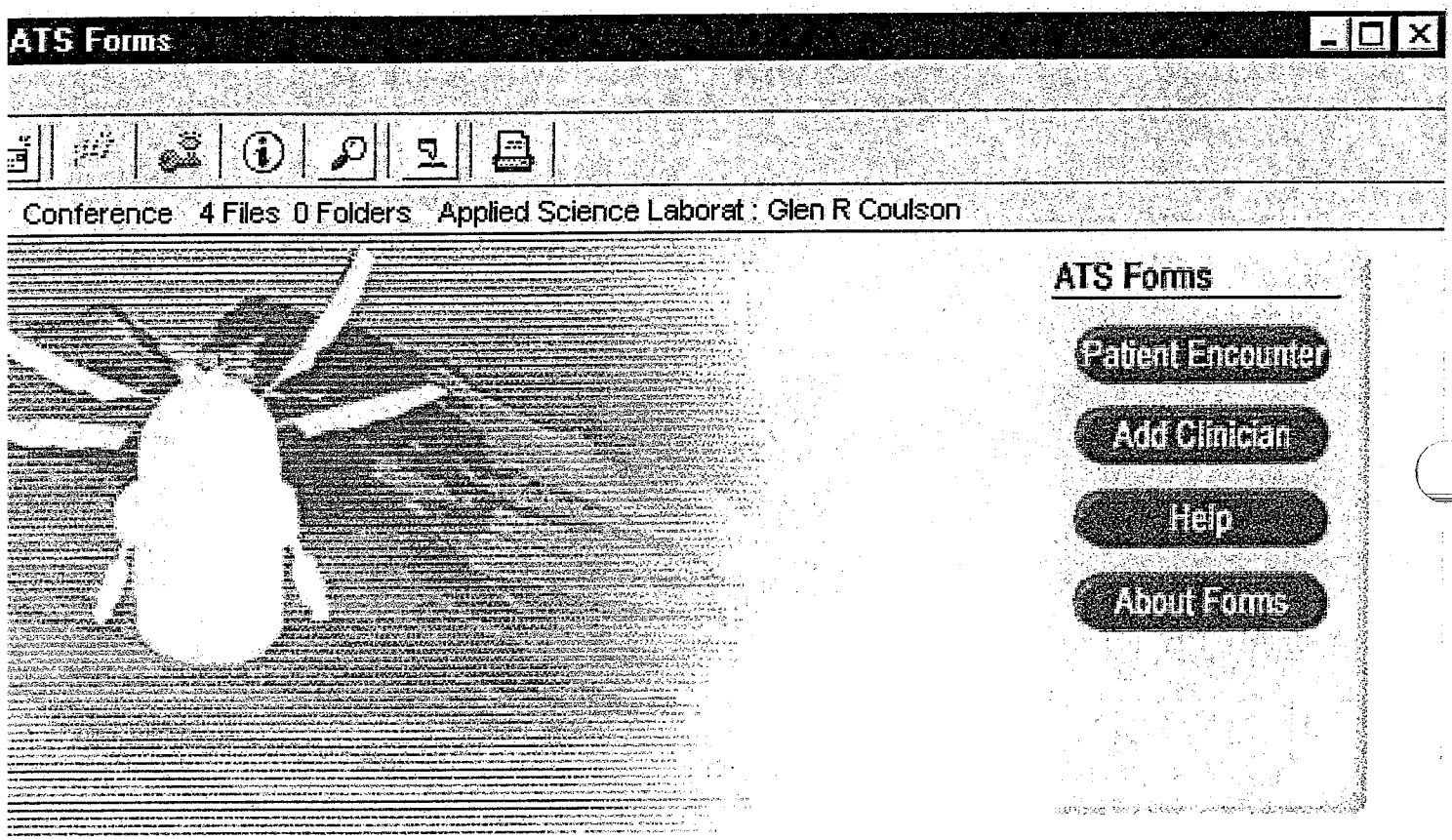
Add Clinician

Help

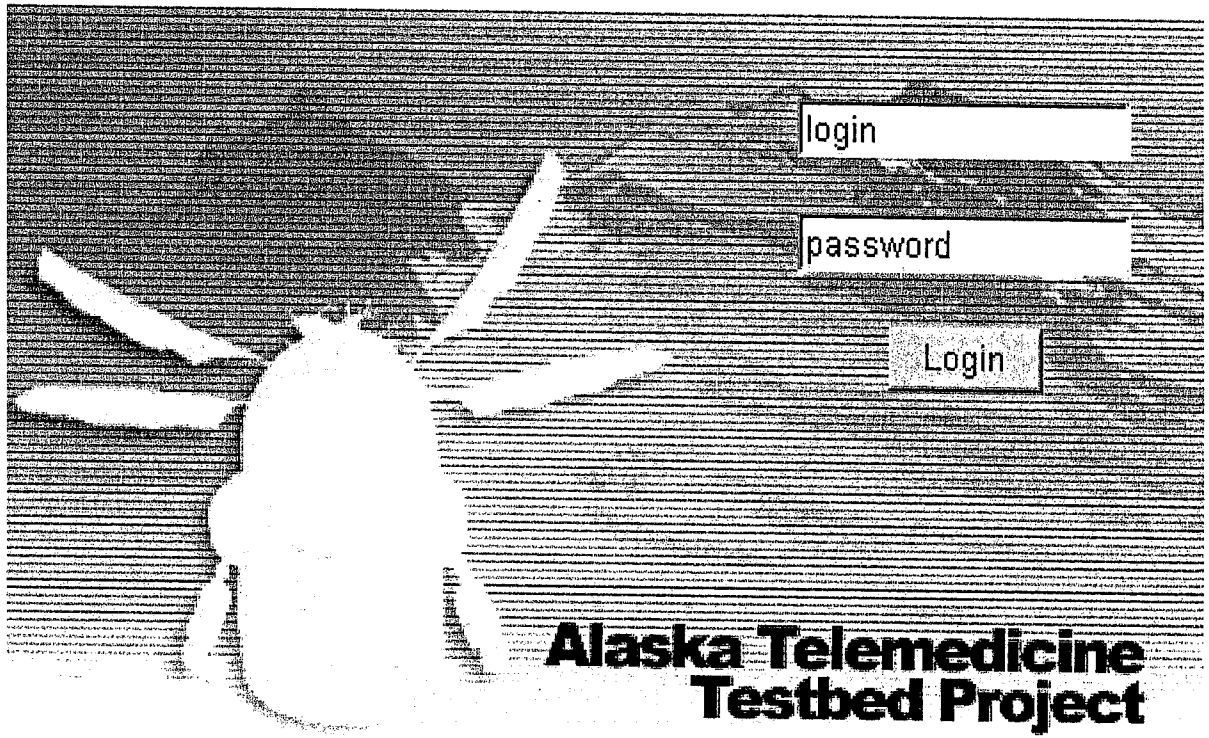
About Forms

1 Item selected.

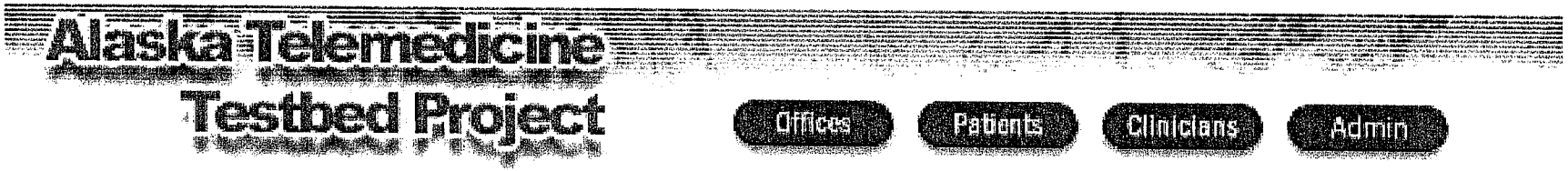
8.15


ATS Forms
Conference 4 Files 0 Folders Applied Science Laborat : Glen R Coulson
ATS Forms
Patient Encounter
Add Clinician
Help
About Forms

8.16


login
password
Login
Alaska Telemedicine
Testbed Project

8.17



Alaska Telemedicine Testbed Project

e data base changes constantly.
Click the **Refresh** button below to see latest changes.

Login	Name	Date created	Date updated	Delete
lukas	Lukas-test	11-21-2001 21:10	11-21-2001 21:10	Delete
peter	peter	11-25-2001 10:57	11-25-2001 10:57	Delete
telemed	* Main Administrator (autoadded)	11-25-2001 11:05	11-25-2001 11:05	Delete
test	fred pearce	11-27-2001 07:43	11-27-2001 07:43	Delete

Add New

Refresh

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niminfo@telemedicine.alaska.edu

Alaska Telemedicine Testbed Project

Offices | Patients | Clinicians | Admin

CLINICIANS

Alaska Telemedicine data base changes constantly.
Click the **Refresh** button below to see latest changes.

Clinician's Name	Clinician's Office	Clinician's E-Mail	Date created	Date updated
Carole Rich			11-27-2001 12:17	11-27-2001 12:17
Debbi Kiley	Alaska Ear, Nose, and Throat		02-12-2002 07:59	02-12-2002 07:59
Frederick W. Pearce	Applied Science Laboratory	fpearce@wolfnet.alaska.edu	11-13-2001 19:27	11-13-2001 19:36
Jerome List	Alaska Ear, Nose, and Throat		02-12-2002 07:58	02-12-2002 07:58
Max Payne	Test Office	testemail@email.com	10-07-2001 05:25	10-07-2001 05:25
Ms. Jenna	Test Office	jenna@clinician.office.com	10-01-2001 09:38	10-06-2001 03:24
Oretta Levy	Orto-Dent	dfg@fgh.com	10-09-2001 10:24	10-09-2001 10:24

Add New | Refresh

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Alaska Telemedicine Testbed Project

Offices | Patients | Clinicians | Admin

OFFICE INFORMATION

[Edit office information]

Alaska Ear, Nose, and Throat, 3340 Providence Dr., Anchorage, AK, 99508, NA
Phone: 907.261.3096;
E-Mail: jlist@alaskaent.com

CLINICIANS | PATIENTS | HEALTH PROVIDERS | INSURANCE Co. | HOSPITALIZATIONS

Health Provider's Name	Health Provider's E-Mail	Date created	Date updated
Cancer Center	email@mail.net	11-06-2001	11-06-2001

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Offices | Patients | Clinicians | Admin

OFFICE INFORMATION

[Edit office information]

Alaska Ear, Nose, and Throat, 3340 Providence Dr., Anchorage, AK, 99508, NA
Phone: 907.261.3096;
E-Mail: jlist@alaskaent.com

CLINICIANS | PATIENTS | HEALTH PROVIDERS | INSURANCE Co. | HOSPITALIZATIONS

Name of Insurance Co.	Policy #	Activation Date	Expiration date
Alaska Blue Cross/Blue Shield		00-00-0000	00-00-0000

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12.8

Alaska Telemedicine Testbed Project | DATA BASE

Back

ADD NEW OFFICE

Office Name	
Office Street Address	
City	
State	
Zip code	
Country	
Phone 1	
Phone 2	
E-Mail	

Clear Fields | Update | Cancel

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Alaska Telemedicine Testbed Project

Offices | Patients | Clinicians | Admin

OFFICE INFORMATION

[Edit office information]

Alaska Ear, Nose, and Throat, 3340 Providence Dr., Anchorage, AK, 99508, NA
Phone: 907.261.3096;
E-Mail: jlist@alaskaent.com

CLINICIANS | PATIENTS | HEALTH PROVIDERS | INSURANCE Co. | HOSPITALIZATIONS

Clinician's Name	Clinician's E-Mail	Date created	Date updated
Debbi Kiley		02-12-2002 07:59	02-12-2002 07:59
Jerome List		02-12-2002 07:58	02-12-2002 07:58

Add New | Refresh

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Alaska Telemedicine Testbed Project

Offices | Patients | Clinicians | Admin

OFFICE INFORMATION

[Edit office information]

Alaska Ear, Nose, and Throat, 3340 Providence Dr., Anchorage, AK, 99508, NA
Phone: 907.261.3096;
E-Mail: jlist@alaskaent.com

CLINICIANS | PATIENTS | HEALTH PROVIDERS | INSURANCE Co. | HOSPITALIZATIONS

Patient Name	ICD-9	Main Clinician	Date created	Date updated
Fred pearce		Debbi Kiley	02-12-2002	03-28-2002

Add New | Refresh

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niminfo@telemedicine.alaska.edu

8.24

Alaska Telemedicine Testbed Project

Offices | Patients | Clinicians | Admin

OFFICES

Alaska Telemedicine data base changes constantly.
Click the **Refresh** button below to see latest changes.

Name of office	Date created	Date updated	Chief Clinician
(undefined)	09-30-2001 08:02	09-30-2001 08:04	
Alaska Ear, Nose, and Throat	02-12-2002 07:56	02-12-2002 07:56	
Applied Science Laboratory	11-13-2001 19:25	11-26-2001 17:54	Lukas-test
Orto-Dent	10-09-2001 10:22	10-09-2001 10:22	Lukas-test
Test Office	09-30-2001 10:05	09-30-2001 10:05	peter

Add New | Refresh

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niminfo@telemedicine.alaska.edu

825

Alaska Telemedicine Testbed Project | DATA BASE

ack

EDIT PATIENT

OFFICE INFORMATION

Applied Science Laboratory, 3211 Providence Dr, Anchroage
Alaska, 99517, USA
Phone: 907.786.6487;
E-Mail: ASL@appliedsci.uaa.alaska.edu

Patient account #	081-42-2166
Patient Name	Fred Pearce
Chief Complaints	chronic stuffy nose
Primary clinician	Frederick W. Pearce
Consulting clinician	Frederick W. Pearce
Additional Info Page	Edit...
Health Providers Page	Edit...
surance Companies Page	Edit...
Hospitalizations Page	Edit...
ast Medical History Page	Edit...

Update Cancel

8.26

Alaska Telemedicine Testbed Project

Offices | Patients | Clinicians | Admin

Alaska Telemedicine data base changes constantly.
Click the **Refresh** button below to see latest changes.

Patient Name	ICD-9	Main Clinician	Date created	Date updated
Fred Pearce	802.0	Frederick W. Pearce	11-13-2001 19:28	03-28-2002 17:16
Fred pearce		Debbi Kiley	02-12-2002 08:00	03-28-2002 17:19
Jay London	784.9; 739.0	Max Payne	10-09-2001 10:11	12-26-2001 13:36
Joe Test	422.91; 920; 920; 920	Ms. Jenna	09-30-2001 10:07	10-13-2001 11:52
Oleg Korablev	478.1	Ms. Jenna	10-09-2001 10:12	12-11-2001 08:23
Oliver Twist	099.3; 755.21; 380.00	Oretta Levy	10-09-2001 10:24	12-25-2001 19:55

Refresh

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Alaska Telemedicine Testbed Project | DATA BASE

Back

ADD NEW CLINICIAN

Login	
Password	
Specialization	Drop-down list of specializations
Title	Click to select
Name	
Address 1	
Address 2	
City	
State	
Zip code	
Country	
Phone 1	
Phone 2	
E-Mail	

Clear Fields | Update | Cancel

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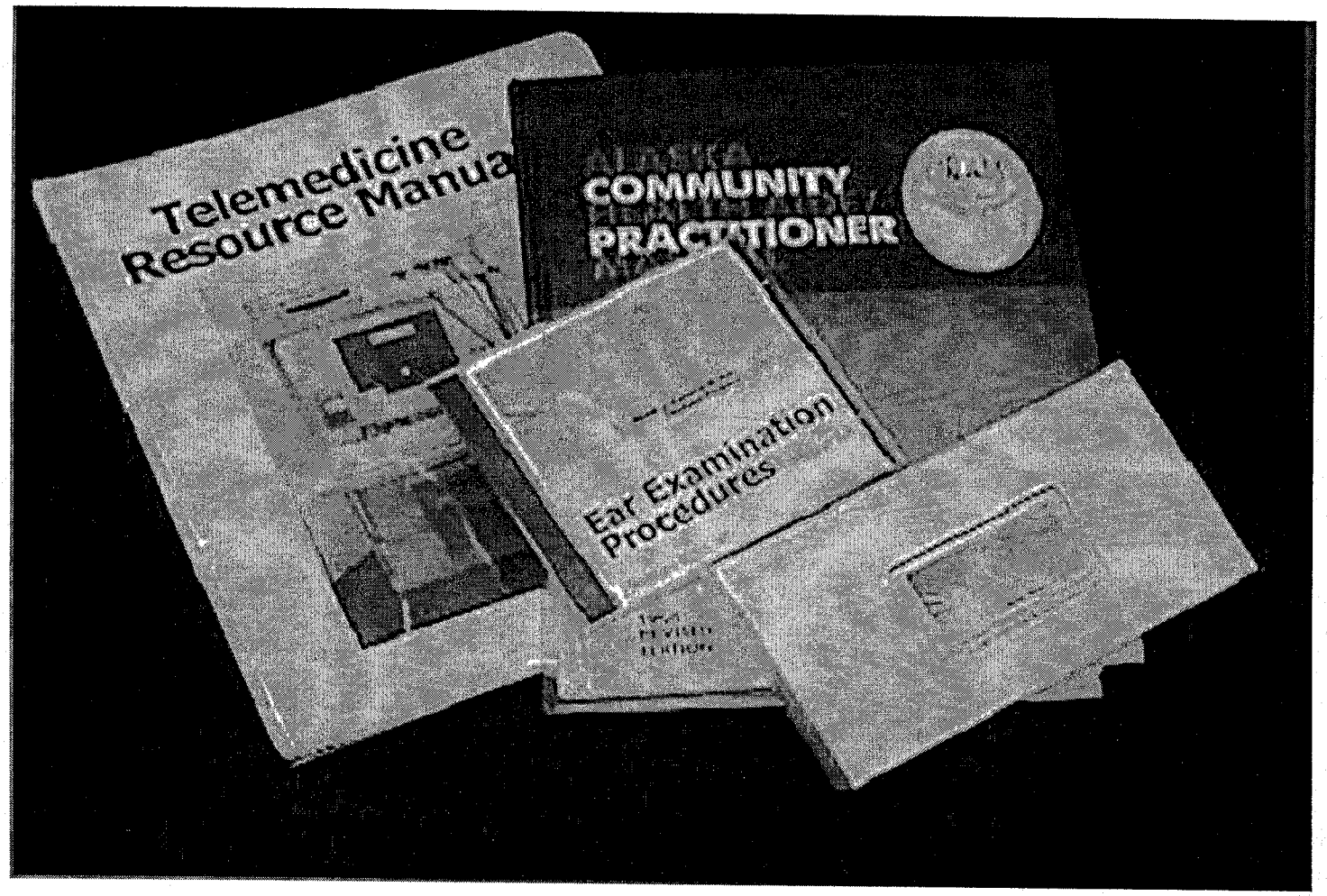
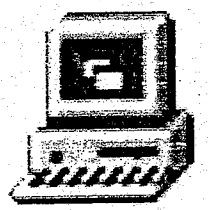
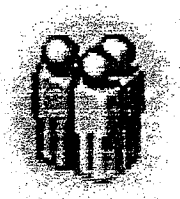
niminfo@telemedicine.alaska.edu

8.28


Telemedicine
Resource Manua
COMMUNITY
PRACTITIONER
Ear Examination
Procedures

Alaska Telehealth Workstation Reference Manual





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NO1-LM-6-3540
ATS v.6

9.2

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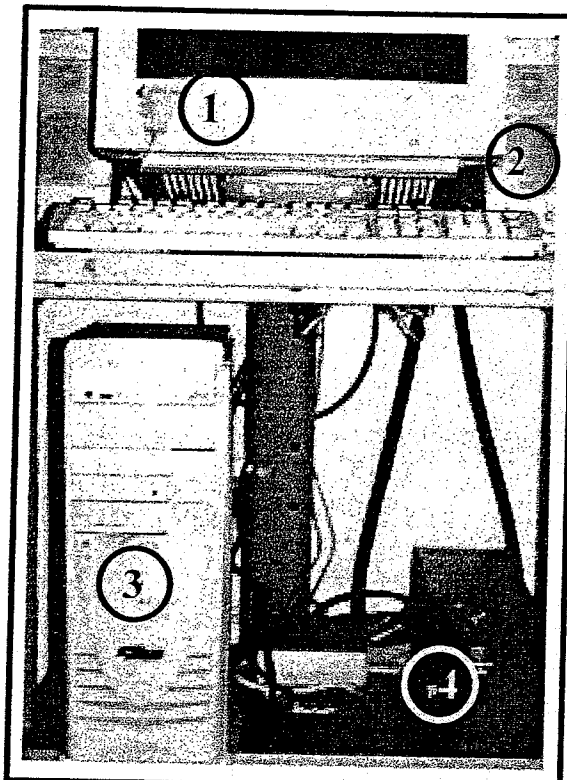
STARTING YOUR COMPUTER



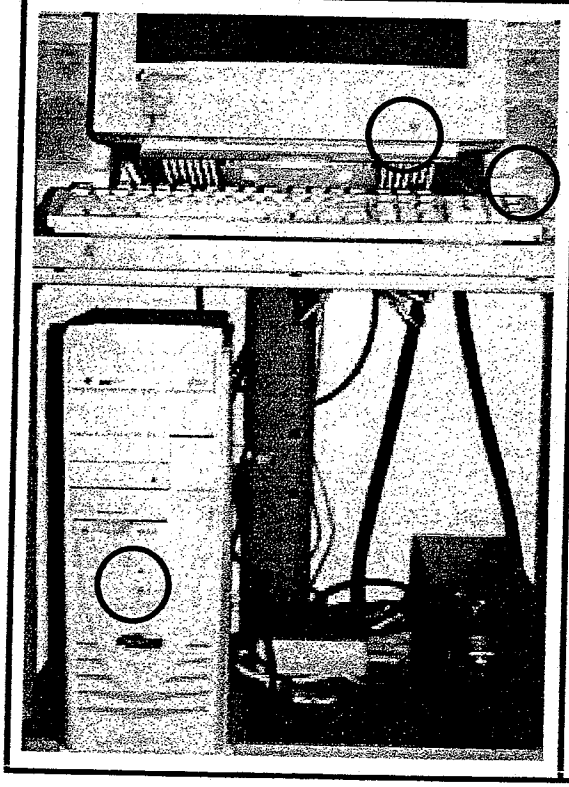
TURN ON MAIN POWER

Press the flat button on the gray box (4) (Power Supply, Uninterruptible Power Supply, or Battery Backup) located on the bottom shelf.

GREEN POWER LIGHTS WILL LIGHT UP ON EACH PIECE OF EQUIPMENT.

1. Monitor
2. Speakers
3. Computer
4. Power Supply (UPS)

The printer turns on automatically when a print job is requested.



IF ANY OF THE GREEN POWER LIGHTS DO NOT COME ON, PRESS THE POWER BUTTON FOR THAT PIECE OF EQUIPMENT.

IF ANY OF THE GREEN LIGHTS STILL DOES NOT COME ON, CHECK THE POWER CORD CONNECTIONS ON THE BACK OF THAT PIECE OF EQUIPMENT AND AT THE WALL SOCKET.

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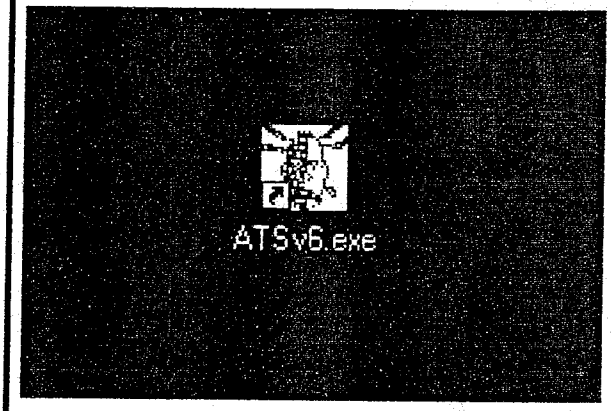
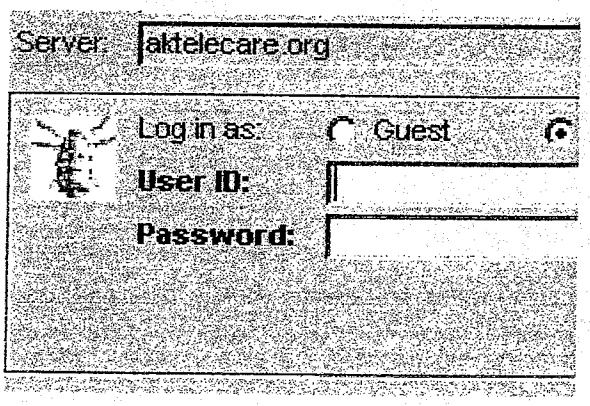
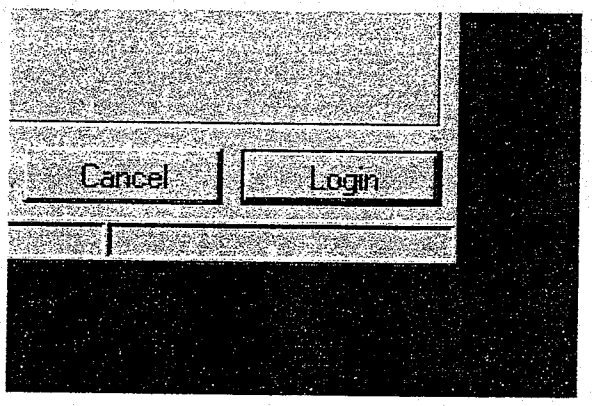
9.5

CREATING A CASE
LOGIN

	**LOGIN** Double Click on **ATSv6** icon.
	Enter **User ID** and **Password**.
	Click on **Login.** **ATS Desktop** appears.

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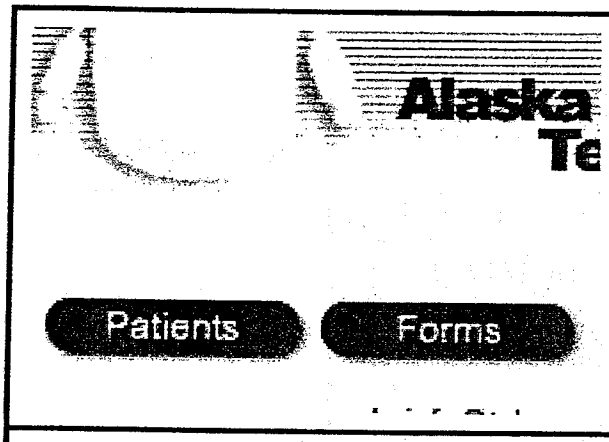
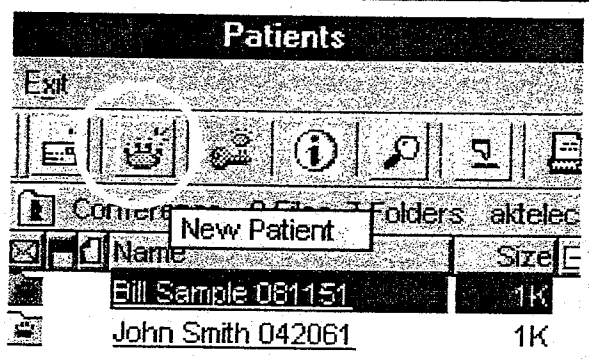
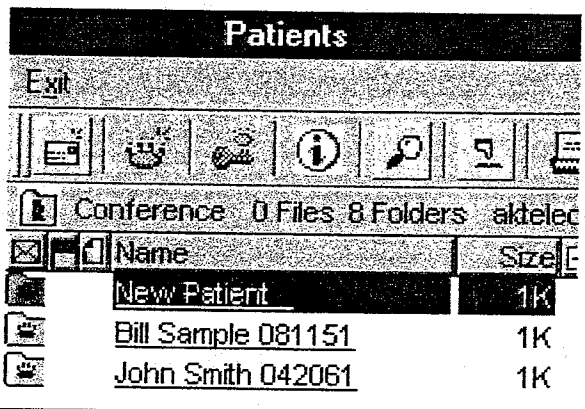
9.16

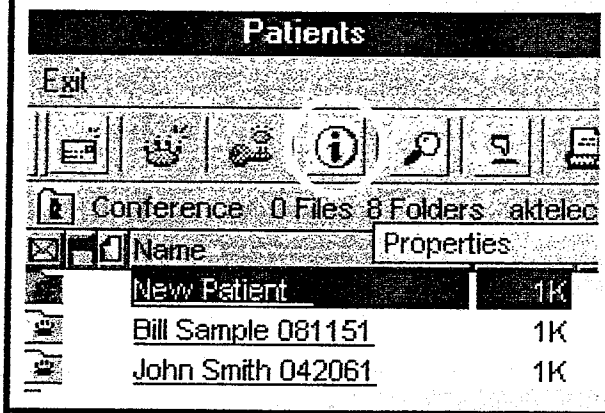
CREATING A CASE

NEW PATIENT

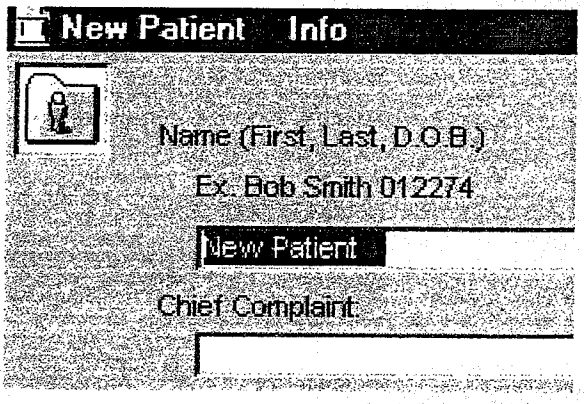
	Click on **Patients** button.
	Click on **New Patient** icon.
	Highlight **New Patient.**

CREATING A CASE

NEW PATIENT INFORMATION



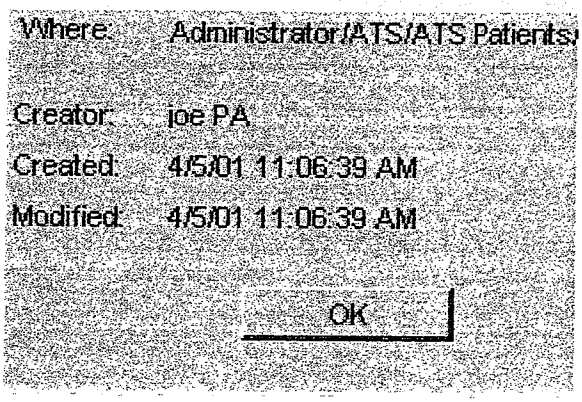
Click on **Information (Properties)** icon.



Enter **Name** and 6 digit **Date of Birth** (000000).

Enter **Chief Complaint** (primary problem).

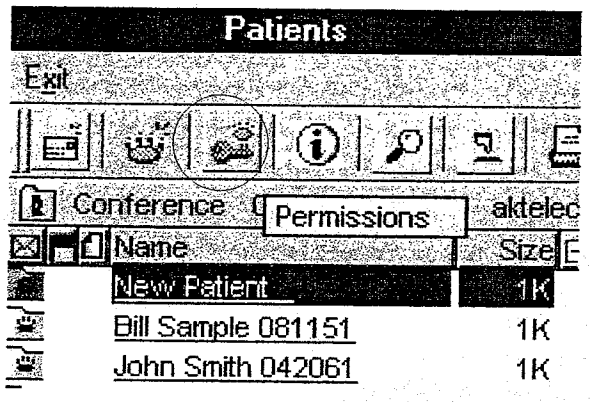
If the Patient has previously been seen (has a folder), enter or change Chief Complaint.



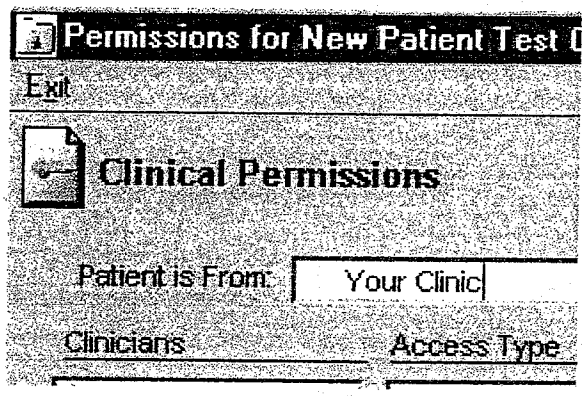
Click on **OK** to save information on New Patient. This person now has a file that you can create a case for.

Close Window.

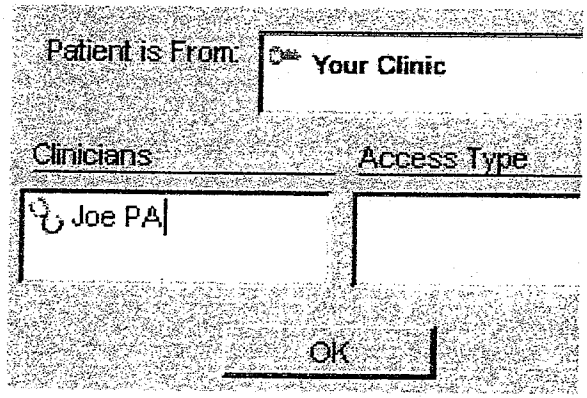
CREATING A CASE
PERMISSIONS



Click on **Permissions** icon to allow other clinicians to "see" your patient.

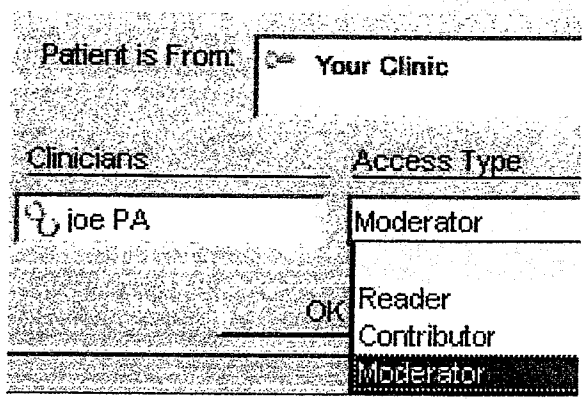


Enter **Patient is From**_____. (Your clinic name)



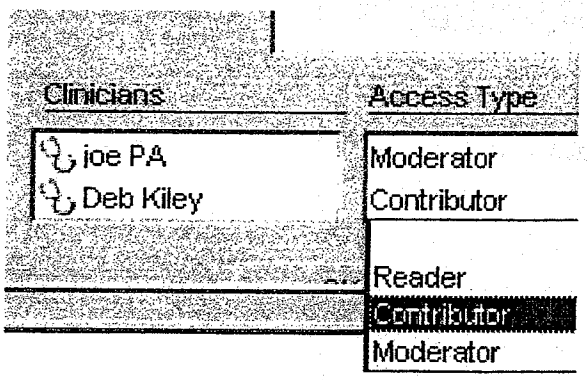
Enter your name in **Clinicians** box.

CREATING A CASE
PERMISSIONS



Click on **Access Type** box and select **Moderator** (creator of the case) from the dropdown list.

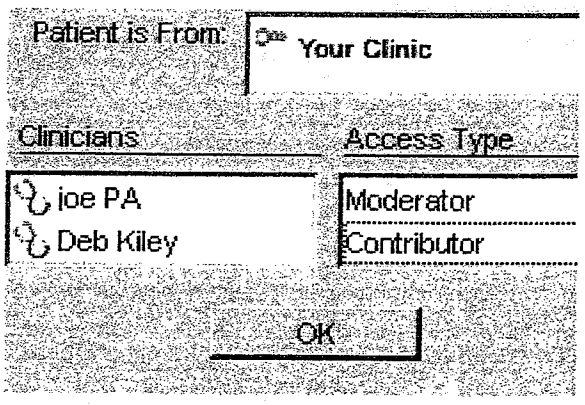
Note: You will not be able to access the file if you miss this essential step.



Add other clinicians you want to have access to the file, giving them the appropriate privileges for access.

Contributor: Can read and post messages (add to the file).

Reader: Read access only.



Click **OK** when done.

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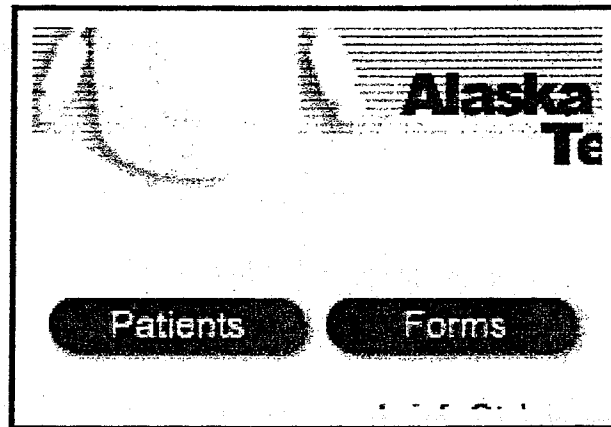
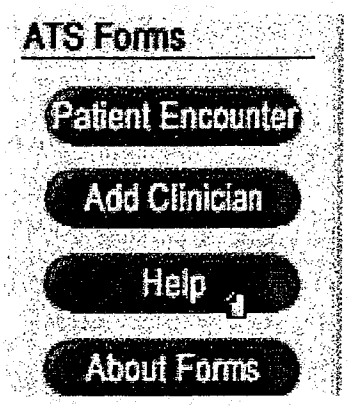
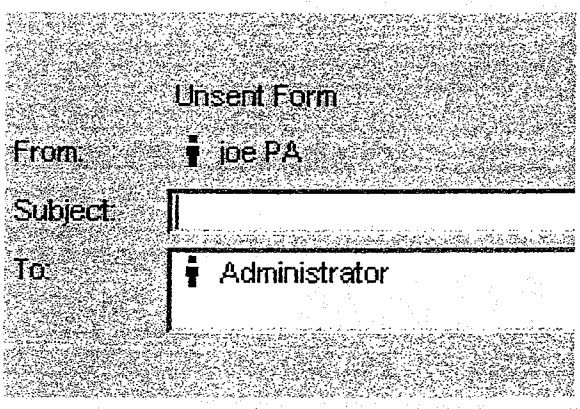
9.10

CREATING A CASE
ADD CLINICIAN

	If the Clinician is not listed in the Directory, go to **Forms**.
	Click on **Add Clinician**.
	Enter **Subject** (Chief Complaint).

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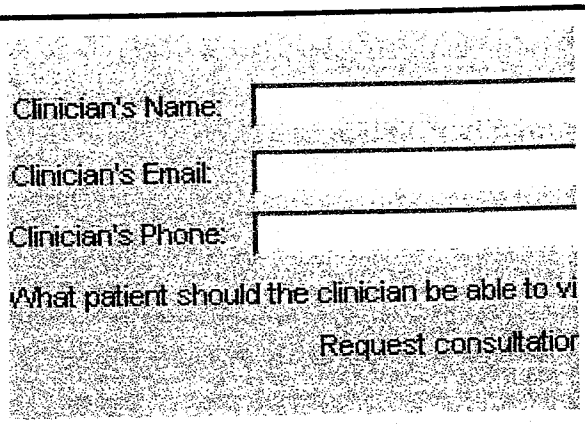
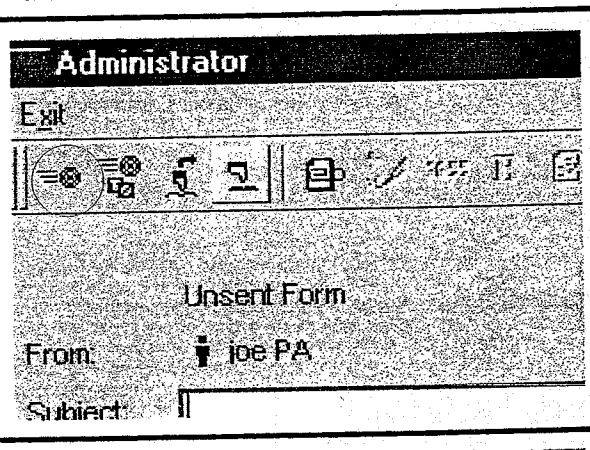
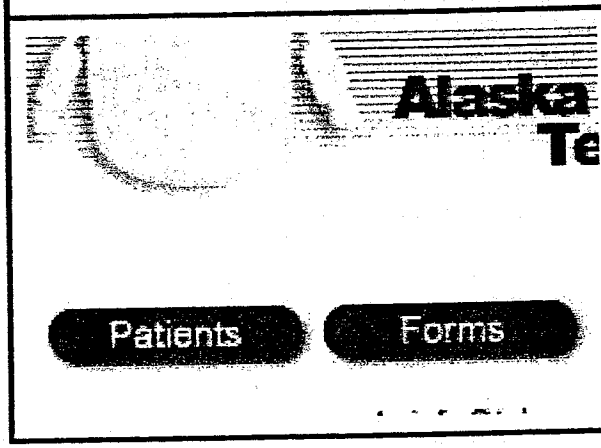
CREATING A CASE
ADD CLINICIAN CONT.

	Enter **Clinician's Name:** **Clinician's E-mail:** **Clinician's Phone:** **What Patient:** When **you want the consult:**
	Click on **Send** icon. Expect a turn around time of at least 12 hours before the clinician is added to the system.
	Return to main **ATS Desktop**.

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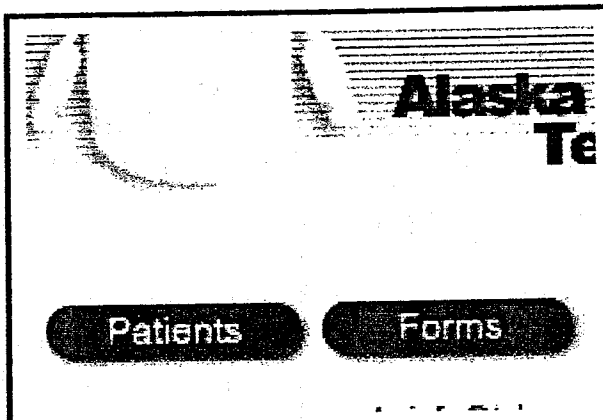
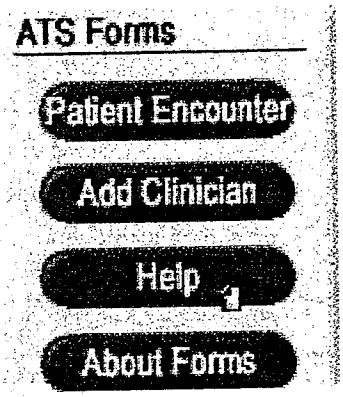
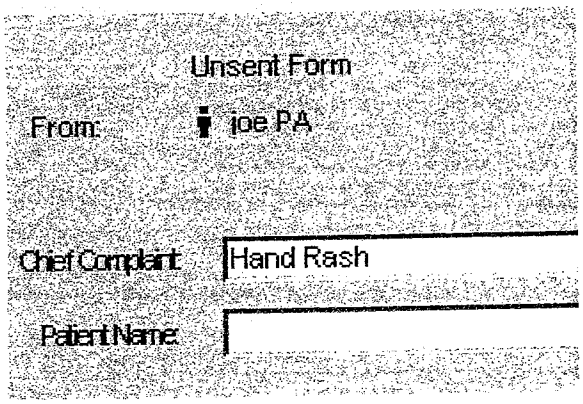
9.12

CREATING A CASE
PATIENT ENCOUNTER FORM

	Click on **Forms.**
	Double click on **Patient Encounter.**
	Enter **Patient Data** (first 3 tabs). **Name Information** Enter **Chief Complaint:** Primary Problem.

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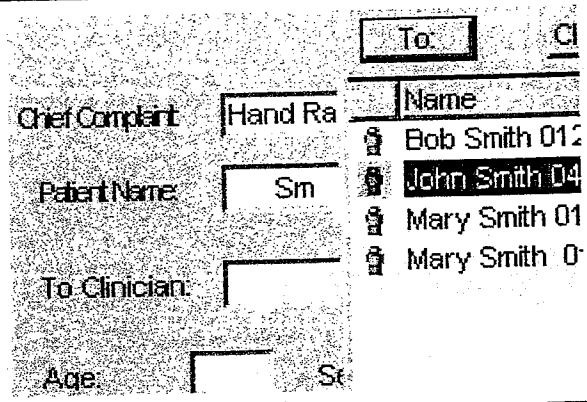
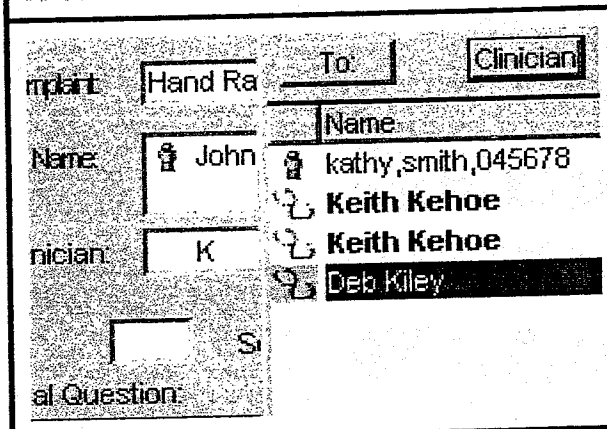
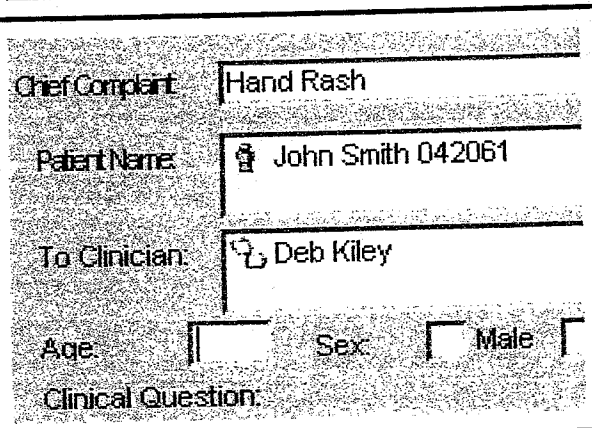
CREATING A CASE

PATIENT ENCOUNTER FORM

NAME INFORMATION TAB

	Click in **Patient Name** box. When you enter the first few letters of the patient's first or last name, hit **Enter** or click on **Directory**, you will be given a list to choose from. Double click on your patient's name and it will automatically be entered into the name box. Directory window closes.
	Click on **To Clinician** box. Enter the first or first few letters of the clinician's name, hit **Enter** or click on **Directory**. You will be given a list to choose from. Double click on the clinician of your choice to fill in **To Clinician** box.
	Directory window closes automatically.

9.14

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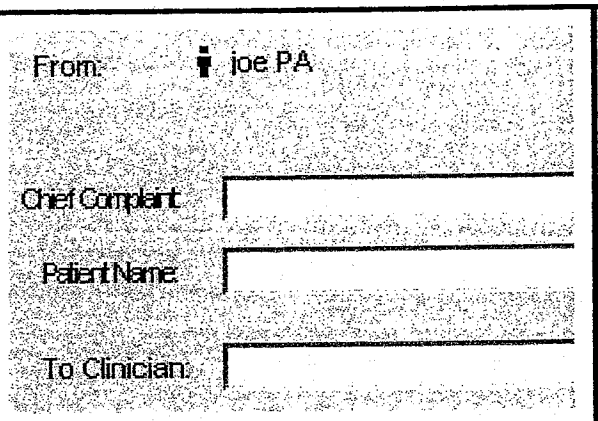
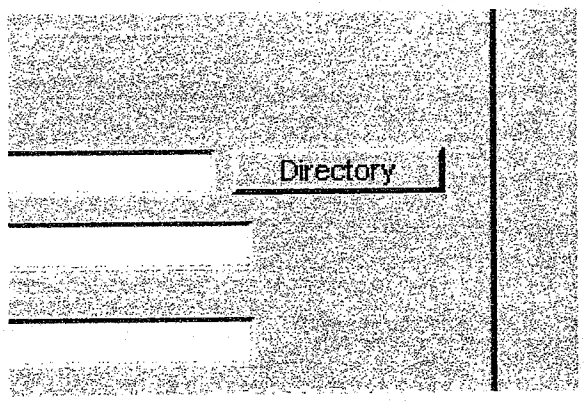
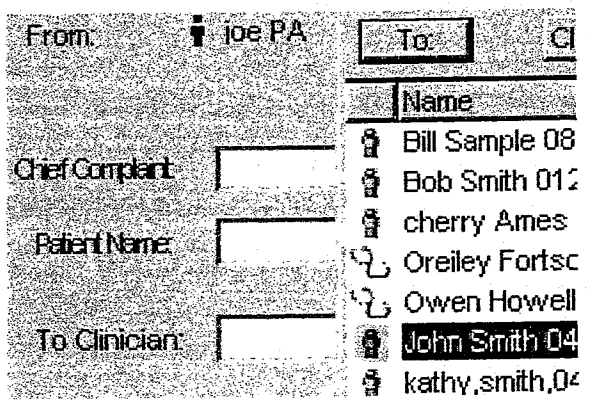
CREATING A CASE

AN ALTERNATIVE WAY TO USING THE DIRECTORY

	**Patient Name** and **To Clinician** can be entered using the Directory.
	Click on **Directory**.
	The Directory window can be moved over so that you can observe names being entered onto the Patient Encounter Form. Click on the name of the patient to highlight.

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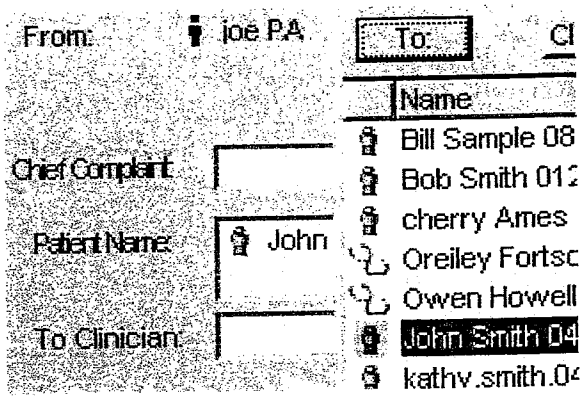
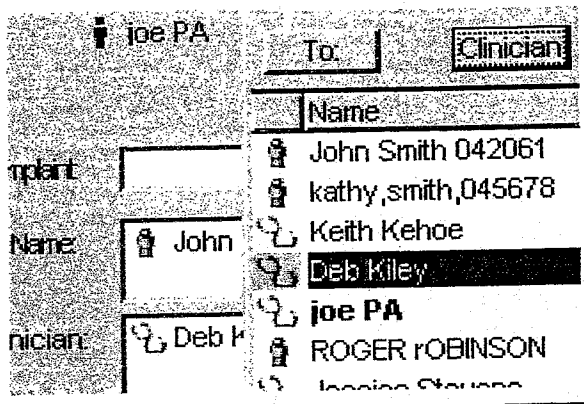
CREATING A CASE
DIRECTORY CONT.

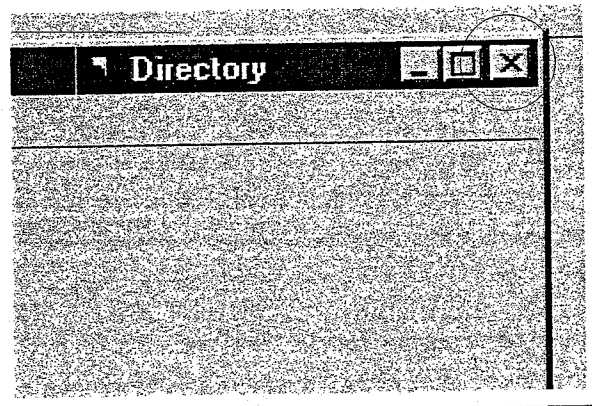


Click **To:** to enter Patient name.



Click on name of Clinician to highlight.

Click on **Clinician** to fill in To Clinician:



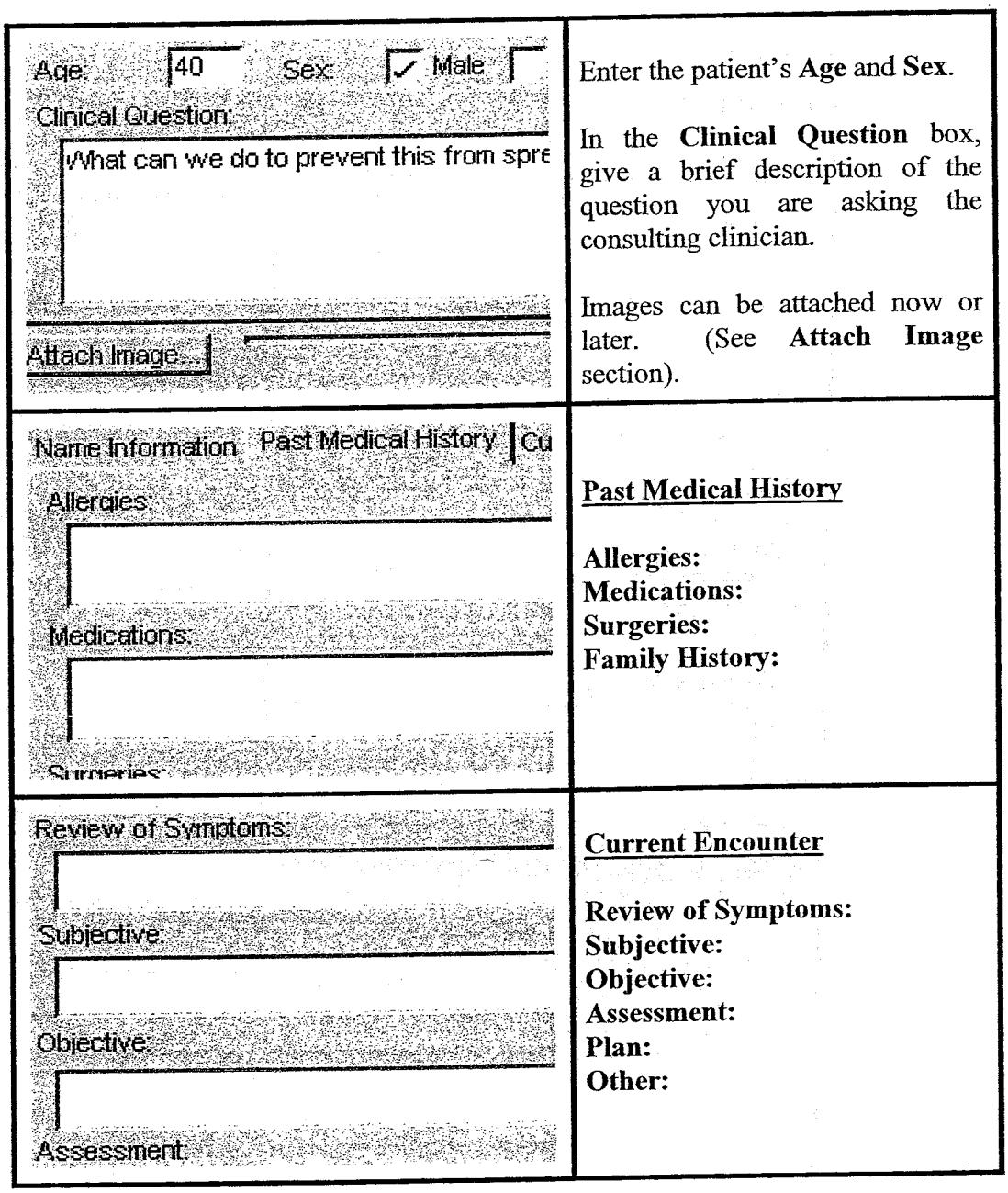
Close Directory Window.

Continue filling in the **Name Information** tab.

CREATING A CASE

PATIENT ENCOUNTER FORM

CLINICAL QUESTION
PAST MEDICAL HISTORY TAB
CURRENT ENCOUNTER TAB



Enter the patient's **Age** and **Sex**.

In the **Clinical Question** box, give a brief description of the question you are asking the consulting clinician.

Images can be attached now or later. (See **Attach Image** section).

Past Medical History

Allergies:
Medications:
Surgeries:
Family History:

Current Encounter

Review of Symptoms:
Subjective:
Objective:
Assessment:
Plan:
Other:

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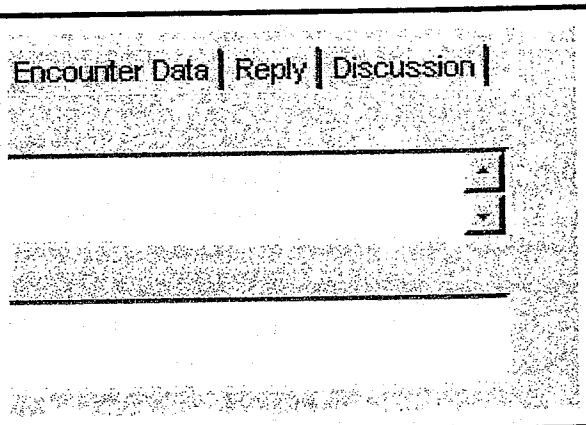
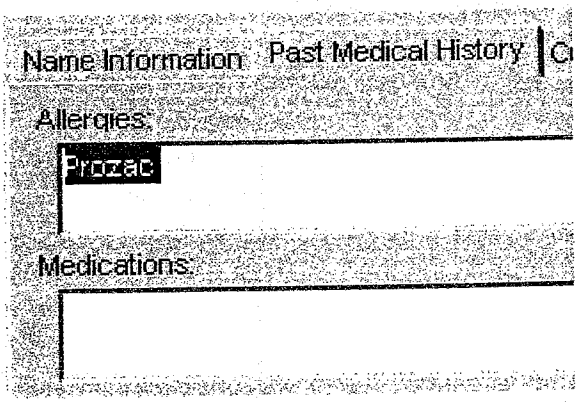
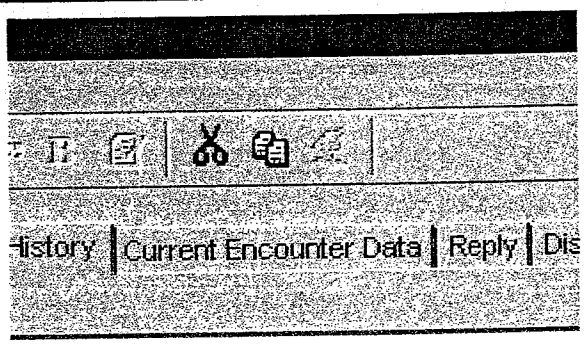
 9.17

CREATING A CASE

PATIENT ENCOUNTER FORM

FIELD BOX ARROWS
CUT & PASTE FUNCTION

	Arrows for scrolling will appear when you click on that field box. This allows you to enter and read more information than what may be apparent for that field box.
	If you enter data into the wrong field box, save time by highlighting it and using the **Cut and Paste** function.
	Click on the scissors (cut). Click on the field box that you want to move the data to. Click on paste.

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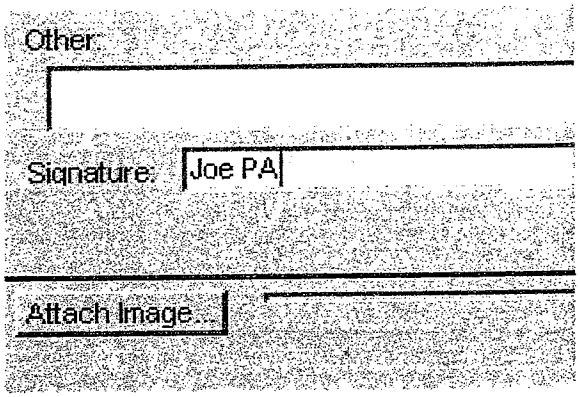
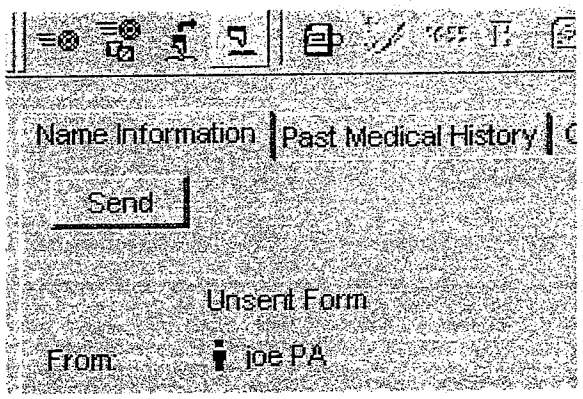
9.18

CREATING A CASE

SIGNATURE BOX & SEND

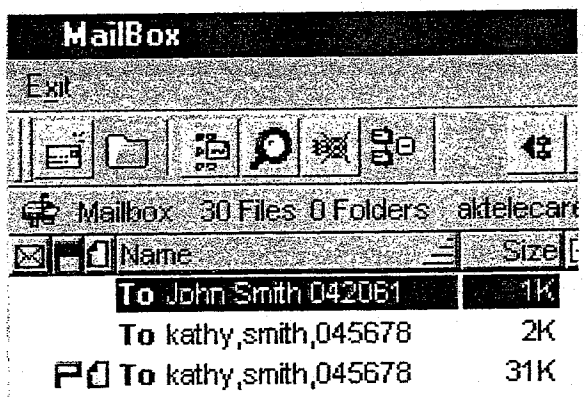


Signature: Be sure to include your name in the Signature box located on the bottom of the Current Encounter tab.



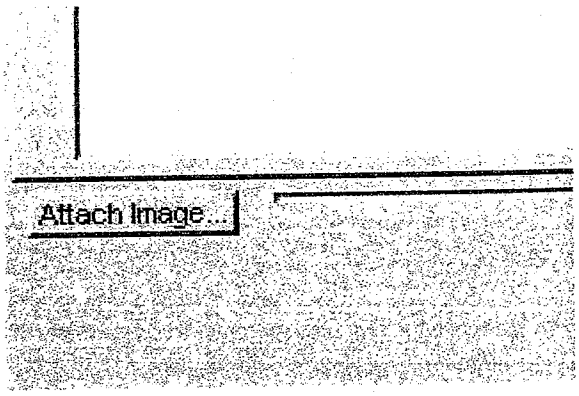
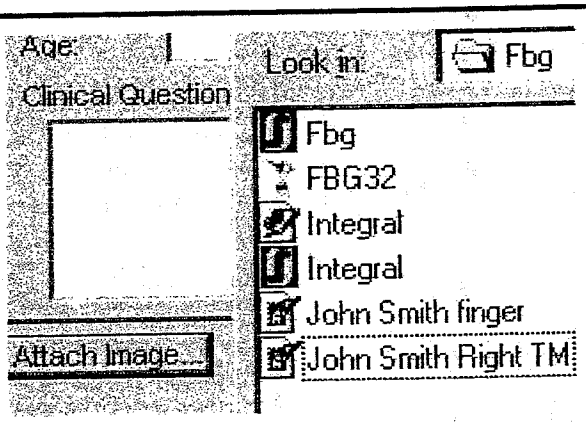
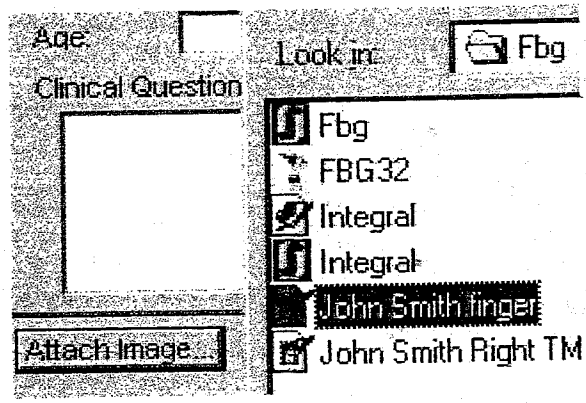
When you have entered all the necessary data, click on the **Name Information** tab.

The **Send** button appears. If you have attached the images, you are now ready to send your case. Click on **Send**.



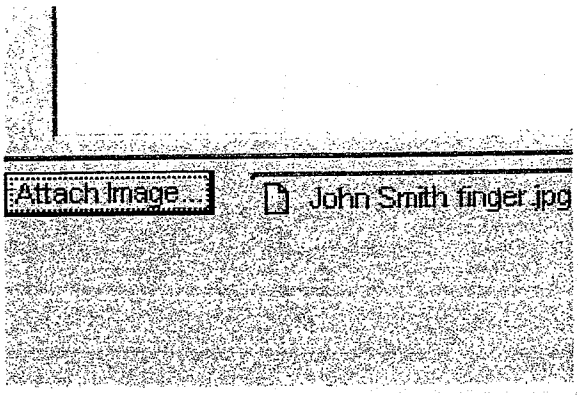
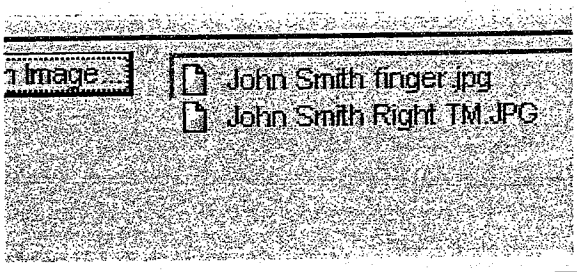
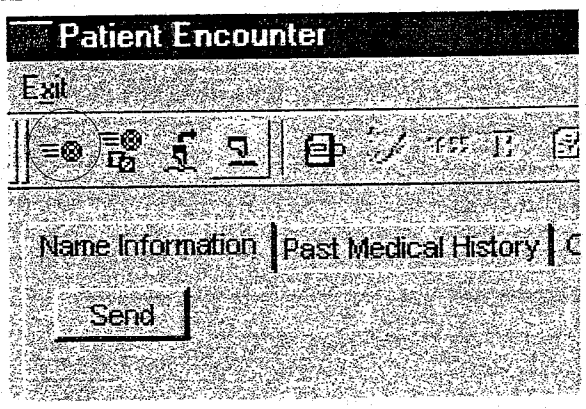
After sending a case, it will appear in your mailbox with no flag next to it.
If you close a case before completing it, it will also be found in your mailbox with red flag outline next to it. Double click on the name to reopen and continue working on the case.

CREATING A CASE
ATTACHING IMAGES

	Click on **Attach Image**.
	The opened **Images** folder from the desktop appears.
	Double click (highlight) on the name of image to be attached to the case.

CREATING A CASE

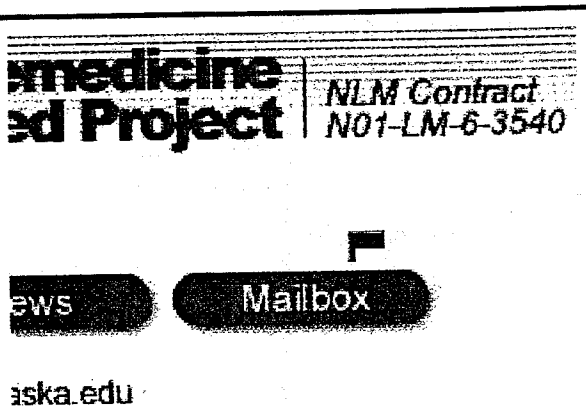
ATTACHING IMAGES CONT. & SENDING

	The image name now appears as attachment next to the Attach Image button.
	If more images are to be included, click on **Attach Image** again and then double click on the next image you want to attach. Continue this process until all your images are attached.
	Click on **Send Icon** or **Send Button** if this is the last step in completing your case.

9.21

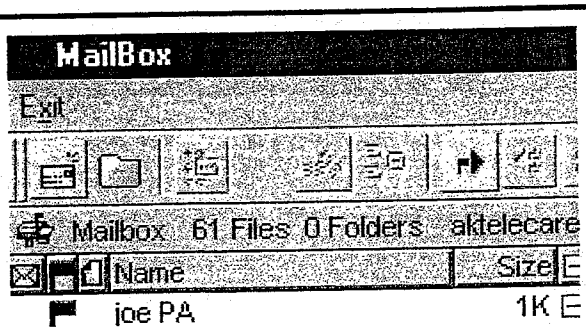
RECEIVING A CASE

MAILBOX



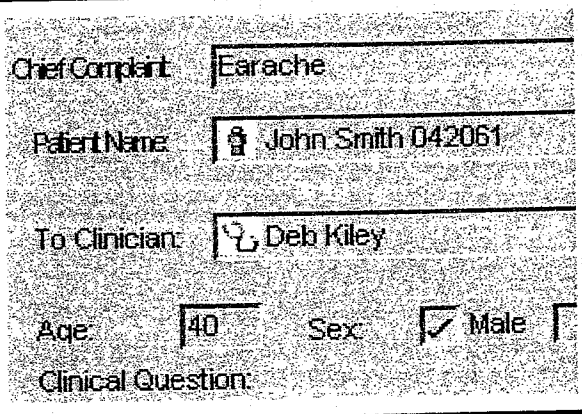
If you have received mail, there will be a solid red flag above the Mailbox button.

Click on **Mailbox**.



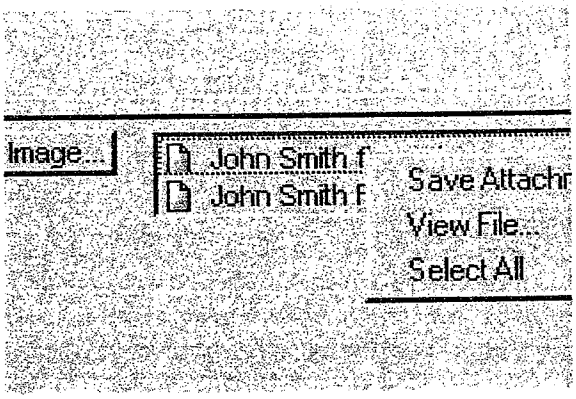
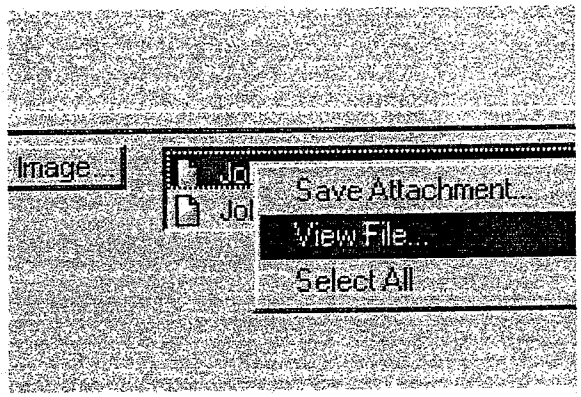
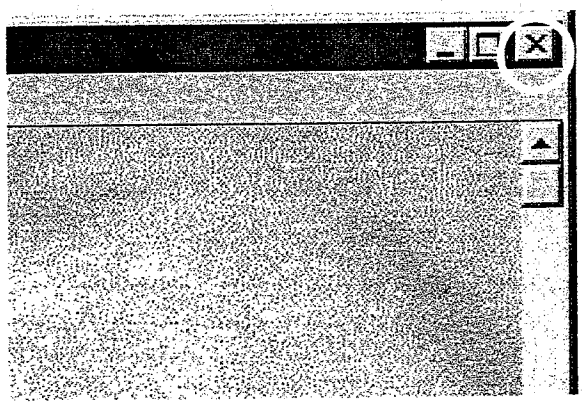
The solid red flag indicates you have received a new case. The sender's name is listed next to the flag.

Double click on the name to open the case.



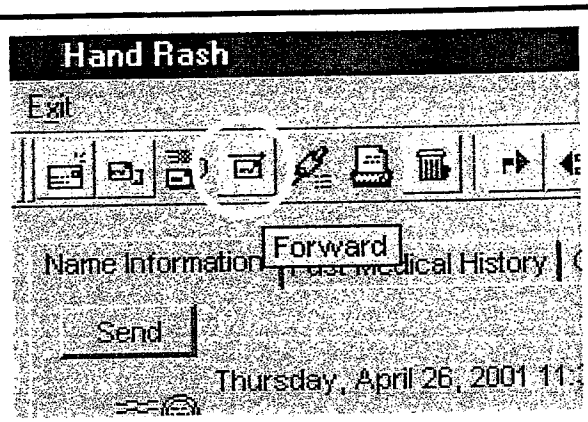
Read through the case, checking the **Name Information**, **Past Medical History,** and **Current Encounter Data** tabs.

RECEIVING A CASE
VIEWING IMAGES

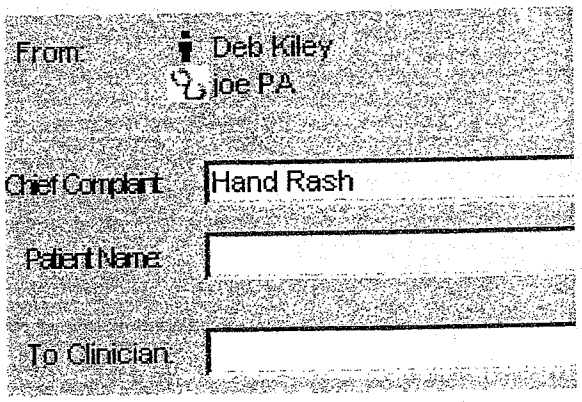
	Be sure to look at any images that may have been sent with the case. **Right click** on the image you want to view.
	Click on **View File**. It will take several seconds for the image to appear.
	When you have finished looking at the image, close the window.

9.23

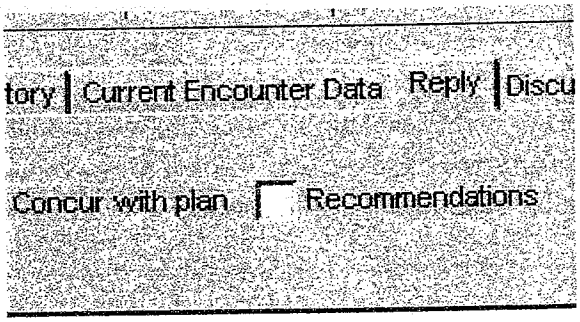
REPLYING TO A CASE
FORWARDING



When you are ready to reply, click on the **Forward** icon.



Reenter **Patient Name** and **To Clinician** (the original sender that you are responding to. In this case you would enter Joe PA in the To Clinician box. Deb Kiley is responding).



Click on the **Reply** tab.

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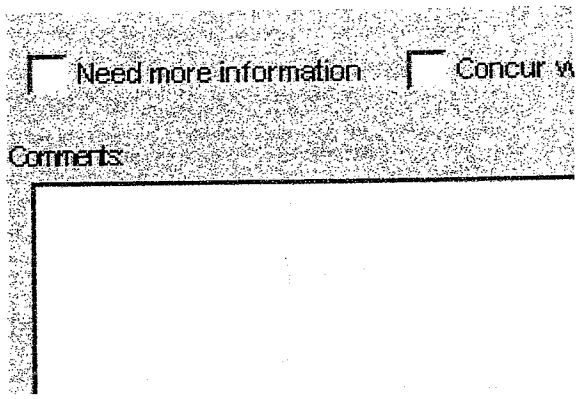
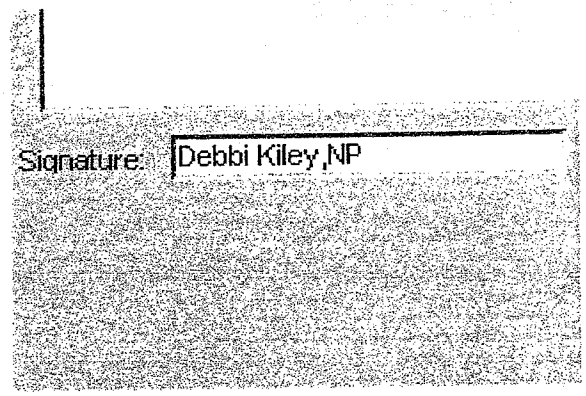
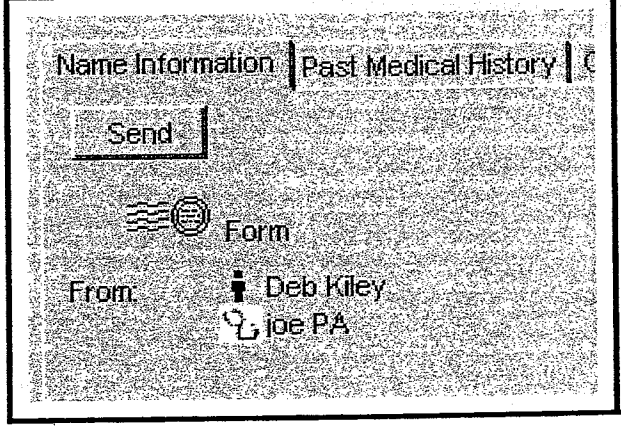
9.24

REPLYING TO A CASE

COMMENTS & SENDING

	Check the appropriate box: **Need more information, Concur with plan** or **Recommendations**. Enter any comments you may have.
	Enter your name in the **Signature** box located at the bottom of the **Reply** tab.
	Click on **Name Information** tab to bring up the **Send** button. Click on the **Send** button to send the reply.

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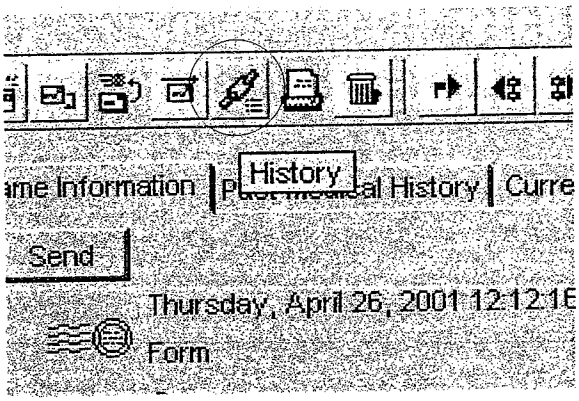
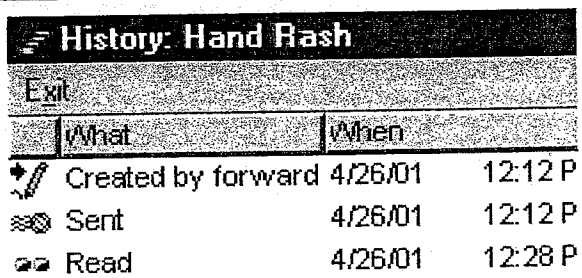
 9.25

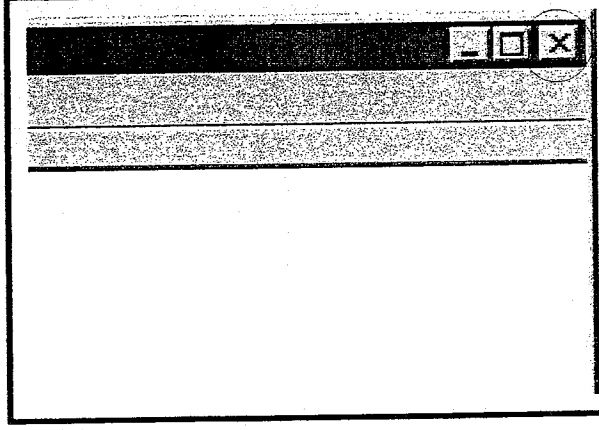
CASE HISTORY
WHO, WHAT & WHEN



If you want to know what has happened with a particular case, click on the **History** icon.



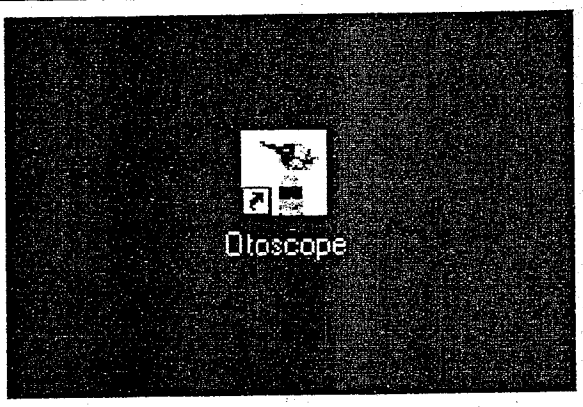
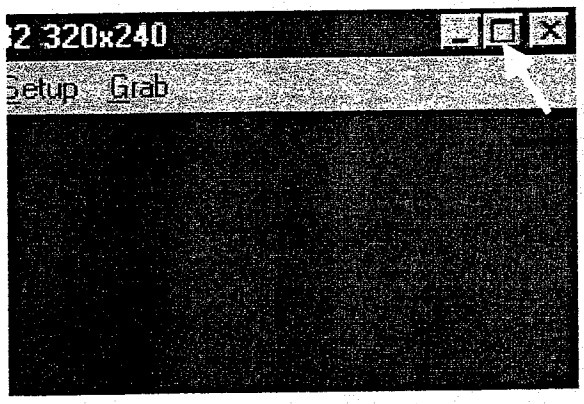
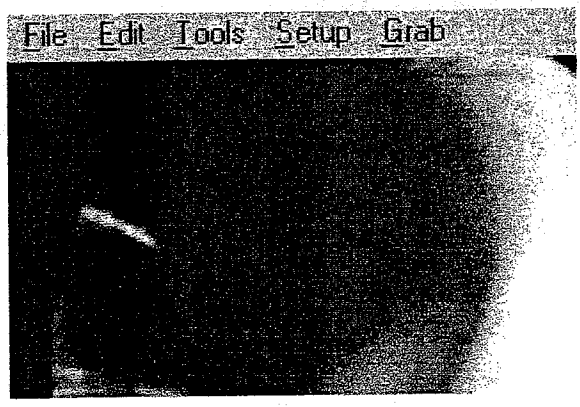
History will tell you **What** has happened, **When** it happened and **Who** did it.



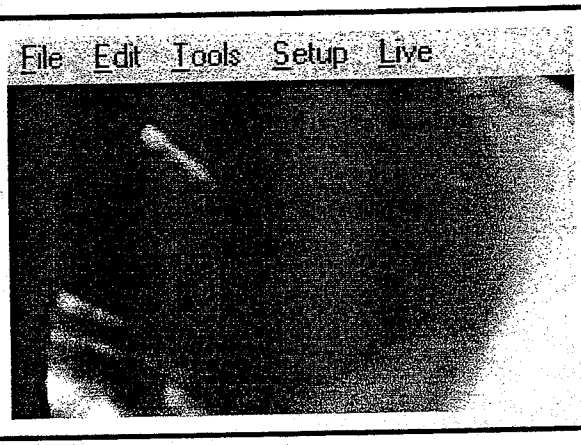
Close History window when finished.

9.26

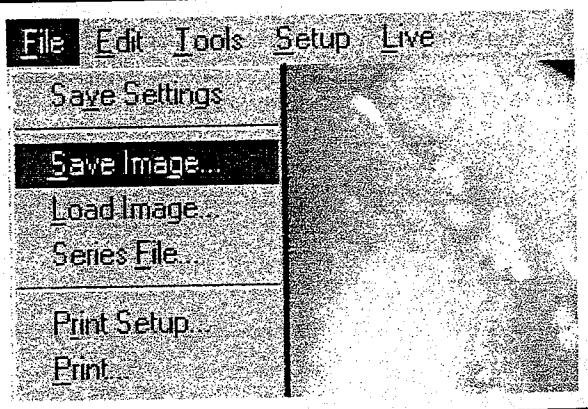
OTOSCOPE IMAGES
CAPTURING IMAGES

	Turn on Video Otoscope. Double click **Otoscope** icon on desktop.
	The view can be enlarged to 640x480 by clicking on the window sizer or by grabbing a corner of the otoscope screen with the mouse arrow and dragging it down and over to 640x480.
	Clicking on **Grab** captures an image and freezes it on the screen. The image can now be named and filed. Each image that you want saved must be **named and filed** after each grab.

OTOSCOPE IMAGES
NAMING & FILING



Click on **File**



Click on Save Image.

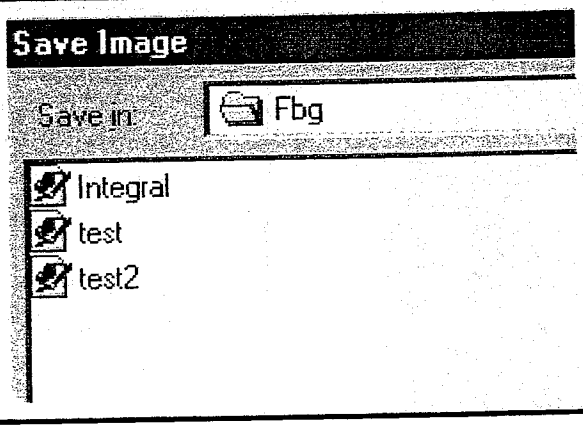


Image will be saved in the desktop folder. **Fbg** is the same folder as the one labeled **Images** on your desktop.

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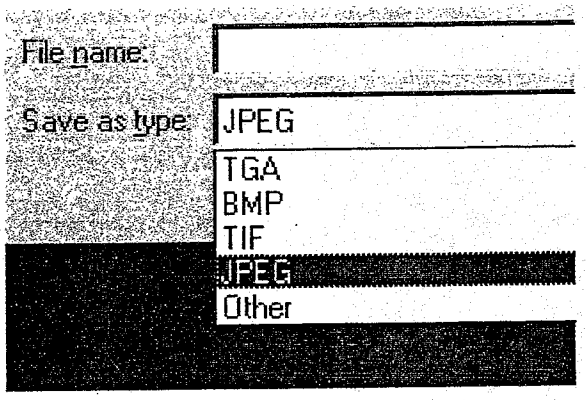
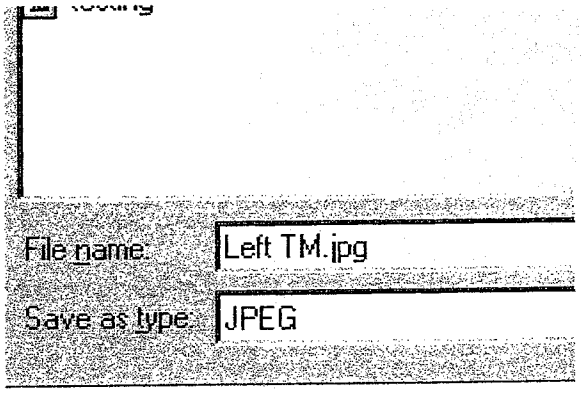
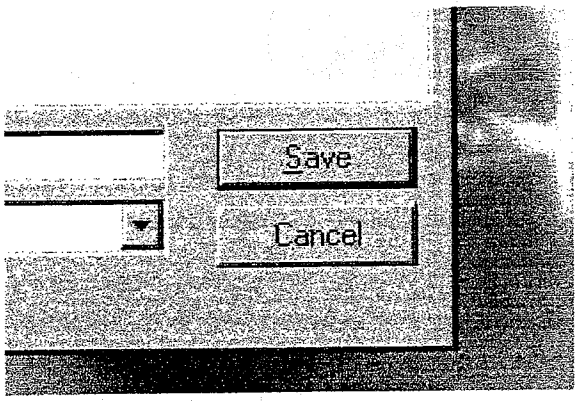
 9.28

OTOSCOPE IMAGES

NAMING & FILING

	Save as type: **JPEG**
	Enter **File name:** You can use the Patient's name, what the image is or a combination of both. All image names must be followed by **.jpg**.
	Click on **Save.** The image is now stored in the desktop folder. Capture another image and repeat the process if more than one image is required. Turn off the video otoscope when finished.

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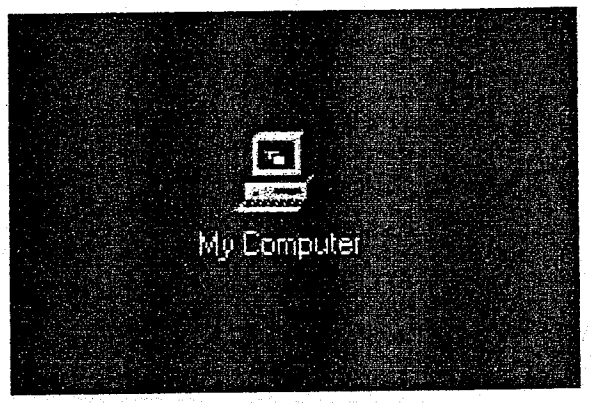
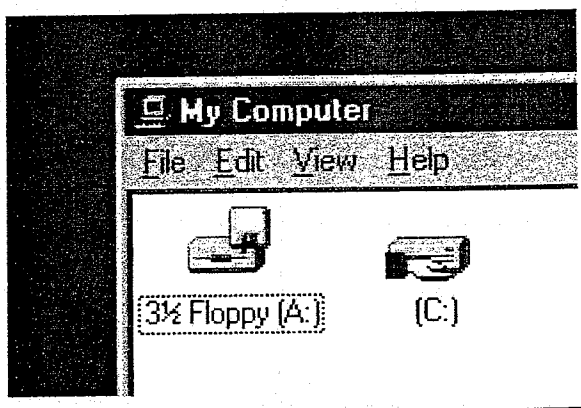
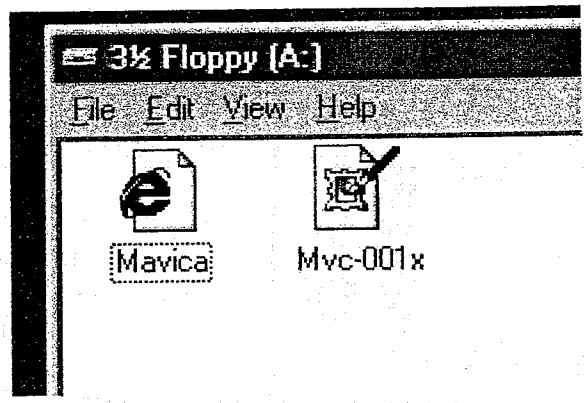
9.29

DIGITAL CAMERA IMAGES

NAMING & FILING

	Capture images with digital camera. Remove disk from camera and insert it into the Floppy A drive of the computer. Double Click on **My Computer** icon on desktop.
	Double click on **3 1/2 Floppy (A:)**
	Images are listed as numbered Mavica images.

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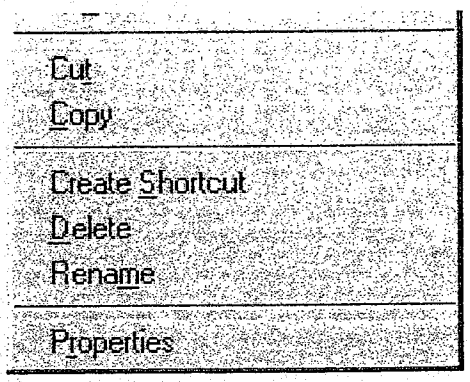
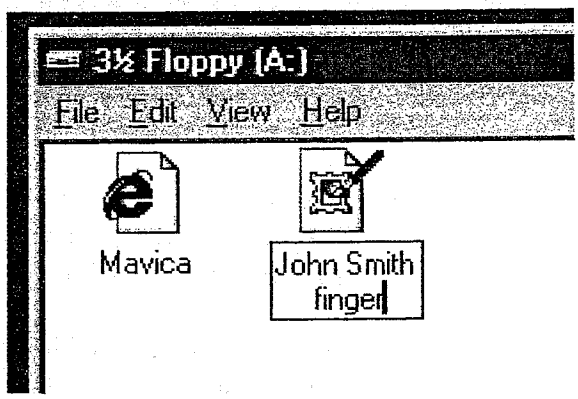
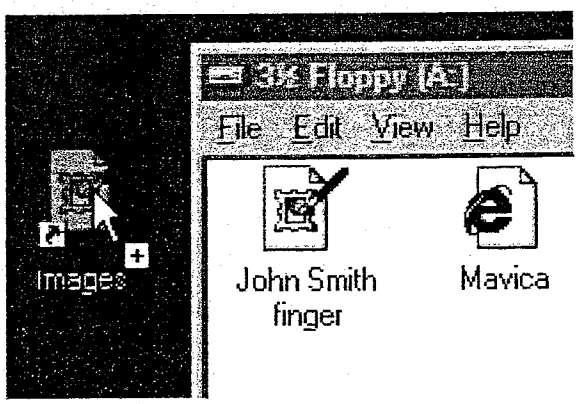
9.30

DIGITAL CAMERA IMAGES

NAMING & FILING IMAGES

	Rename images by right clicking on Mvc-001x and then choose **Rename** from the drop down list.
	The Mvc-001x will be highlighted. Enter new name in highlighted area using patient's name and either numbers or what the image is.
	Drag and Drop: click on image icon and without releasing the mouse button, move the image icon over to the Images folder. Renamed images are now stored in the desktop **Image Folder**.

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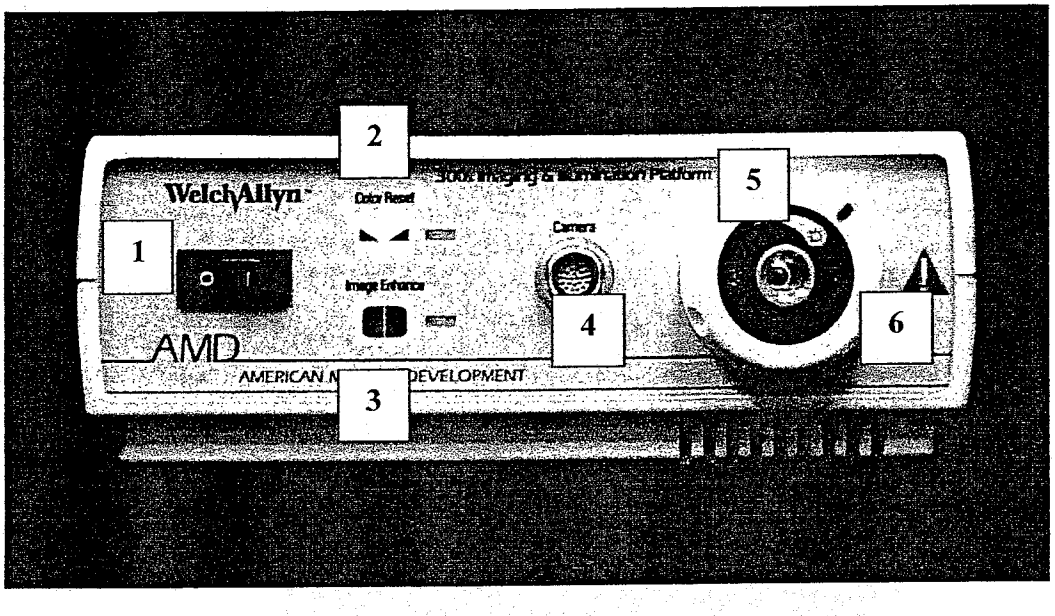
 9.31

OTOSCOPE
FRONT PANEL



1. Power Switch — Turns on and off the power to the light source and camera.

2. White Balance — Ensures the camera accurately recognizes *white* in existing light so that all colors are accurate. Reset with each use.

3. Enhancement — Sharpens the contrast, making the border of objects clearer. This is especially useful with an irregular surface.

4. Camera Connection — To connect: line up the red dots at the top of connection site and the pronged end of the camera attachment. To disconnect: firmly hold the silver ring on the camera connector close to the connection site and pull straight out.

5. Light Connection — To connect: push silver metal fittings together smoothly. To disconnect: hold the metal and rubber end of the light cable firmly and pull straight out. Be very careful not to bend the cable sharply.

6. Light Control Knob — Keep at full brightness. To reduce glare, withdraw otoscope 1/8".

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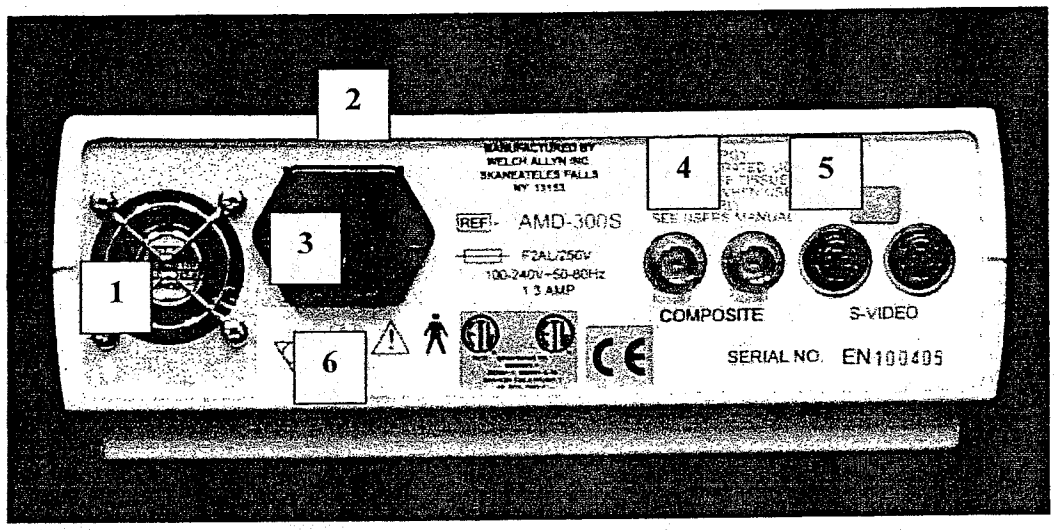
9.32

OTOSCOPE

BACK PANEL



1.	Fan Cover	Fan provides cooling of the light source.
2.	Fuse Drawer	Contains main fuse. Opens for fuse replacement.
3.	Power Input	Power cord connection site.
4.	Video Output	Composite output.
5.	S-Video Output	Connects camera to the computer.
6.	Ground Site	Can be used as a safety ground.

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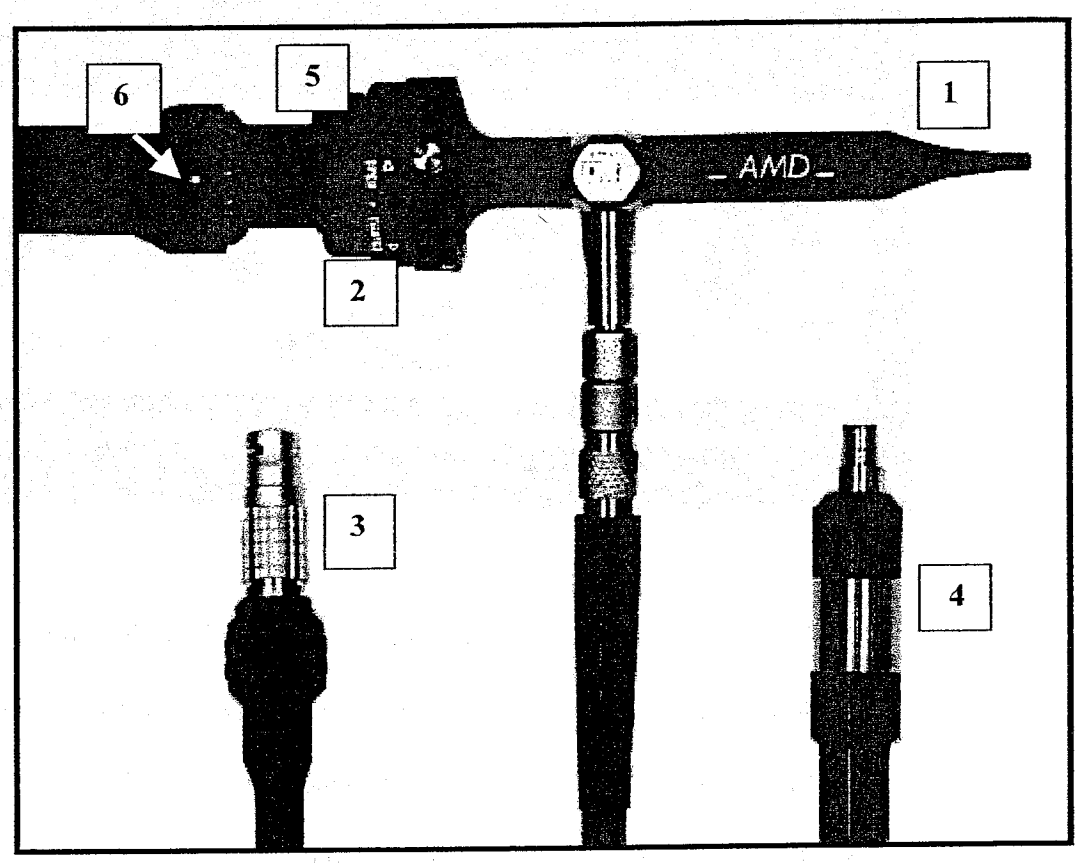
9.33

OTOSCOPE

ENT SCOPE & CAMERA



1. ENT Scope — Clean frequently with alcohol.
2. Camera Coupler
3. Camera Cable
4. Light Cable — Strands of glass fiber optic material could easily be damaged if cable is bent or wrapped in a tight coil.
5. Focusing Ring
6. White Dot — This dot needs to be aimed upright so that the image on the screen is oriented correctly.

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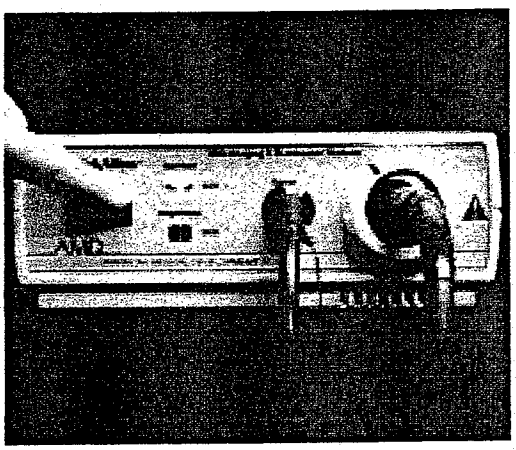
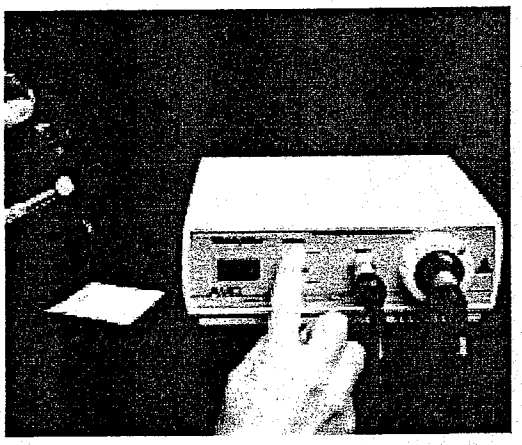
OTOSCOPE

QUALITY CONTROL & USE



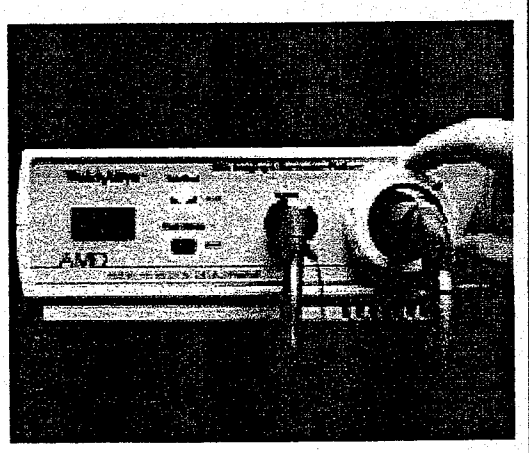
POWER

Make sure all the cables are properly connected before turning on the power. Press the power switch firmly to the right. If the light does not come on, turn it off and wait 30 seconds before trying again. Never turn the power switch on and off rapidly as this could burn out the bulb and damage the internal computer.



WHITE BALANCE

After waiting 30 seconds for the light to warm up, hold the otoscope tip 2 inches from a white surface. Press the color reset button for 3 seconds or until the light to the right stops blinking.
The image on the screen should look the same as the white surface you are focusing on. **Reset White Balance before each use.**



BRIGHTNESS

Adjust light intensity using the light control knob. The camera may be too bright causing a white glow (called a hot spot) in the center of the image.

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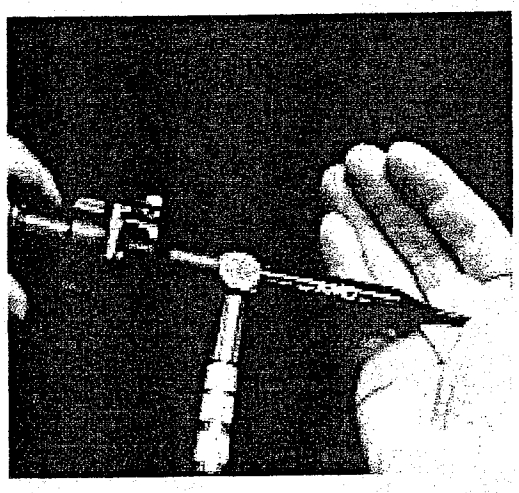
9.35

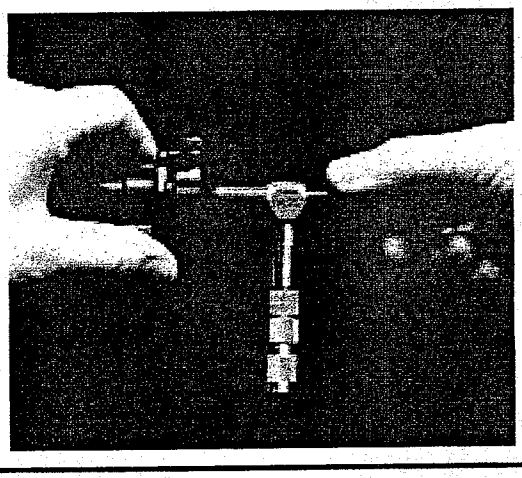
OTOSCOPE

QUALITY CONTROL & USE



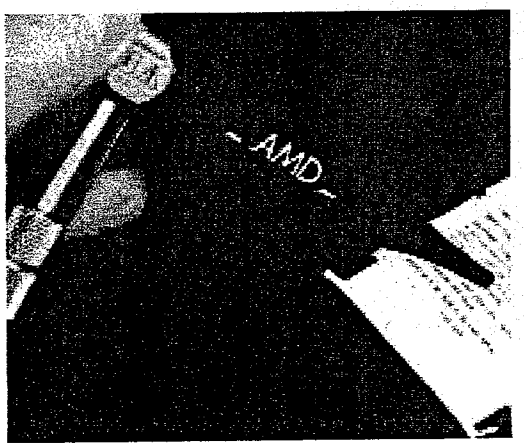
CLEANING TIP

The tip of the otoscope head will require frequent cleaning with a moist alcohol pad to ensure clear pictures. Use an alcohol pad to remove any accumulation of wax, moisture or debris. An insufflator bulb can be used to remove any excess alcohol.



FOCUS

Insert the end of the otoscope into a closed fist with the tip of the scope about 1" from the tip of the little finger.
Using the wings on the coupler, adjust the focus until you have a clear view of the edge of the fingernail and the outside ring of the image on the screen is sharp.



CHECK FOCUS

Use any printed material to check the focus. When holding the tip of the scope 1" from the print, individual letters should have sharp, clear edges and the image on the screen should be readable. If not, the lens may need cleaning.

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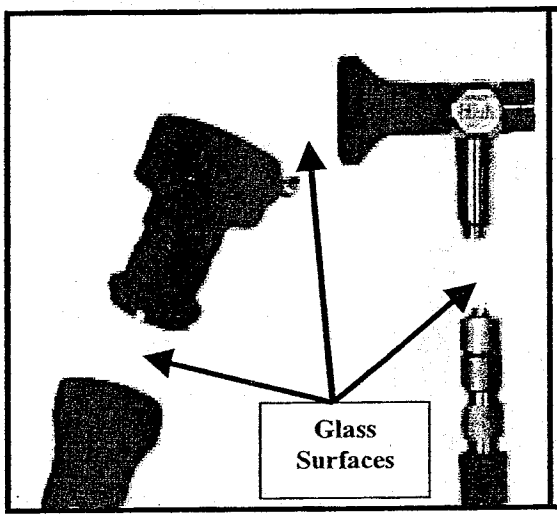
 9.36

OTOSCOPE

QUALITY CONTROL & USE



In addition to the tip of the otoscope head, six other glass surfaces that may require cleaning are shown here. A soft, lint-free cotton cloth can be used to gently clean these surfaces.

Under normal use, there is no reason to separate these parts. Do so only if you can not achieve a clear image by thoroughly cleaning the otoscope tip and you suspect that there may be some sort of debris inside.

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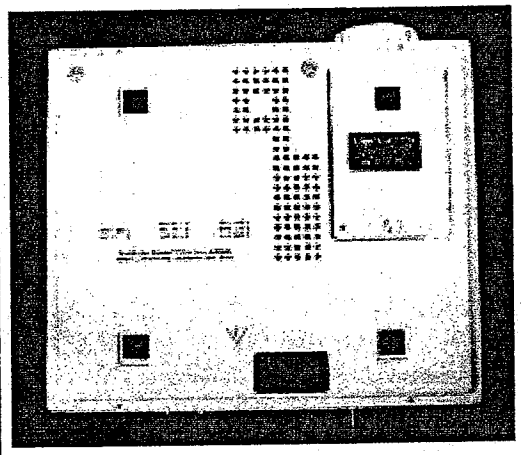
9.37

OTOSCOPE

LAMP REPLACEMENT



1. Caution: Lamp may be hot! Wait at least 15 minutes after turning off the power before handling the lamp.
2. Unplug the power cord from the wall outlet. Turn the box over and lay it on a flat surface.
3. Remove the lamp cover screw and then the cover.
4. Unplug the black electrical connector from the lamp.
5. Grasp the lamp by the ceramic base and with your other hand, gently hold back the tension wires. Remove the lamp.
6. Grasp the new lamp by the ceramic base with the small pin facing up. Be careful not to touch the glass or the reflector cup when handling the lamp. The oil from your hands will cause the glass to fracture when it heats up.
7. Holding back the tension spring, replace the lamp in the fixture. Attach the electrical connector to the base of the lamp. Replace the lamp door and screw.
8. Reconnect camera and light cables. Plug into wall outlet.

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9.38

Medical Photographs

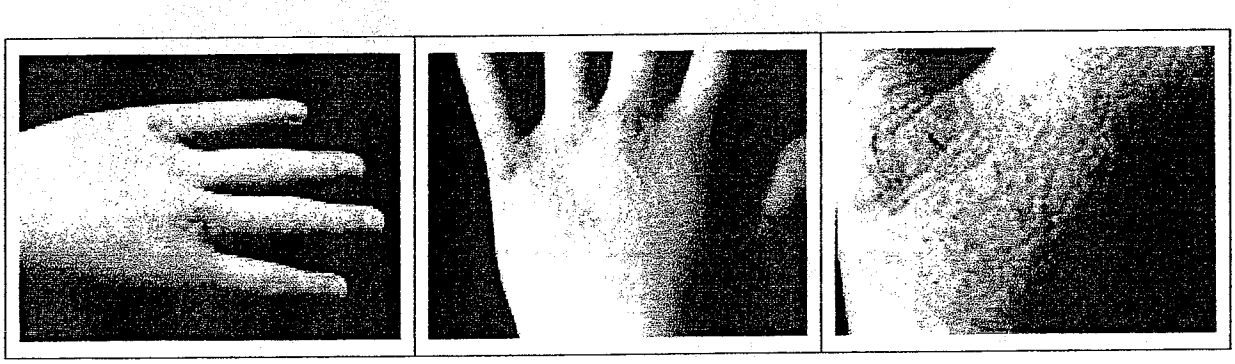
Medical photographs should accurately maximize clinical information presented. Snapshots, on the other hand, contain distracting, extraneous elements such as jewelry, clothing, hair, background furnishings and other irrelevant data that should be minimized or eliminated.

Photographs should concentrate on details of the problem, which need to be highlighted and accurately reproduced.

Factors to consider that may be vital in determining correct diagnosis are:

Exact size – requires a measuring device placed in photograph.
Details – translucency, wrinkling, texture, different hues and colors of lesions, their borders, shape, skin markings.
Depressions or elevations need proper lighting.

Incorporate all clinically relevant information. Three principal views include:
Location – anatomical site(s) of problem.
Scan – distribution, how large is the area involved?
Detail – fine feature close-up.



1. Have patient remove make-up, jewelry or clothing that will interfere with the photograph.
2. Put the subject in front of a clean background free from clutter.
3. Have the camera a least 1- foot away from subject to get proper focus. You may have to use the macro setting on the camera for extreme close-ups.
4. Hold camera perpendicular to subject.
5. Select vertical or horizontal image format for best representation (heads are vertical, mouths are horizontal, etc.
6. Do not have the lens at a wide-angle setting. This tends to distort.
7. Use proper lighting on the subject. Using the camera flash for close-ups will wash out the image.
8. Include the three principal views: Location, Scan and Detail.
9. Once you have captured the images, review them for quality. Ask yourself "What am I photographing?" If the answer differs from what you see through the lens and in your photographs, adjustments must be made.

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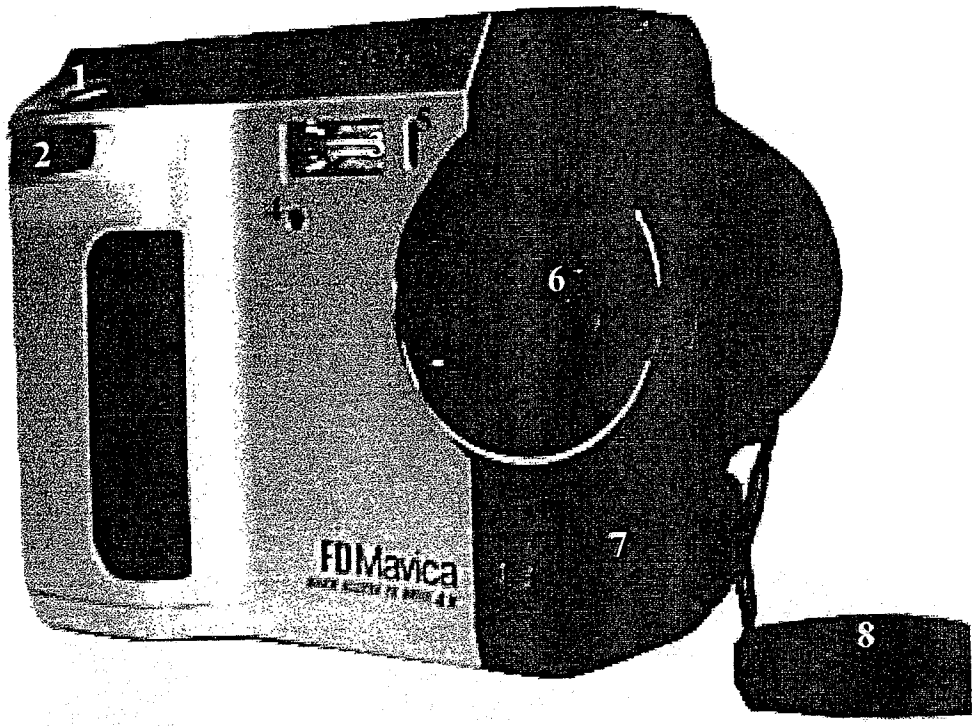
9.3

DIGITAL CAMERA

FRONT

This section is designed to help you get started using the digital camera. Locate the booklet that came with the camera and read it to improve your understanding and use of the camera. Place the booklet with the telemedicine workstation where you and others can find it easily. You will have to practice and experiment with lighting and positioning to improve your skill in capturing clinically useful images.



1. SHUTTER BUTTON
2. ZOOM LEVER
3. FLASH
4. PHOTO CELL WINDOW FOR FLASH – Do not block while recording.
5. SELF-TIMER LAMP
6. LENS
7. DC IN COVER/DC IN JACK
8. LENS CAP

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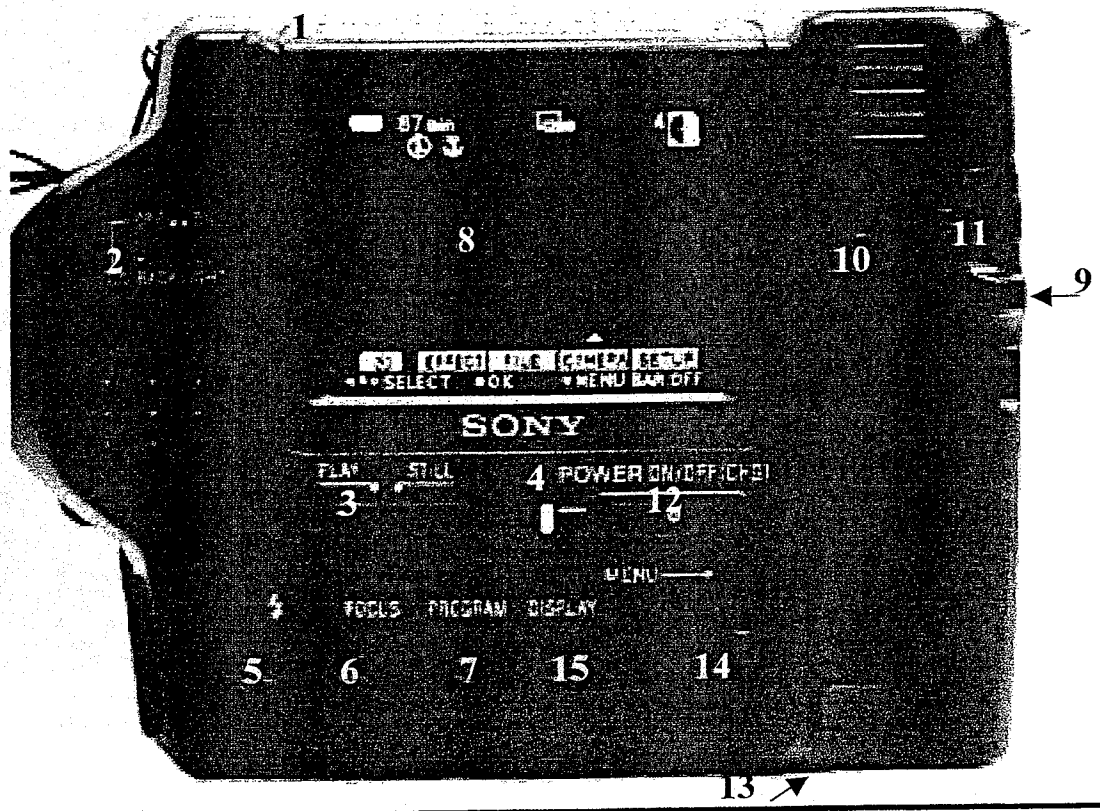
DIGITAL CAMERA
BACK



1. PHOTOCELL WINDOW for LCD screen.	9. FLOPPY DISK SLOT
2. LCD BACKLIGHT SWITCH	10. ACCESS LAMP
3. PLAY/STILL SELECTOR	11. DISK EJECT LEVER
4. POWER ON/OFF & CHARGE LAMP	12. POWER SWITCH
5. FLASH BUTTON & LAMP	13. BATTERY COVER (on bottom)
6. FOCUS BUTTON	14. CONTROL BUTTON
7. PROGRAM AE BUTTON	15. DISPLAY BUTTON
8. LCD SCREEN	

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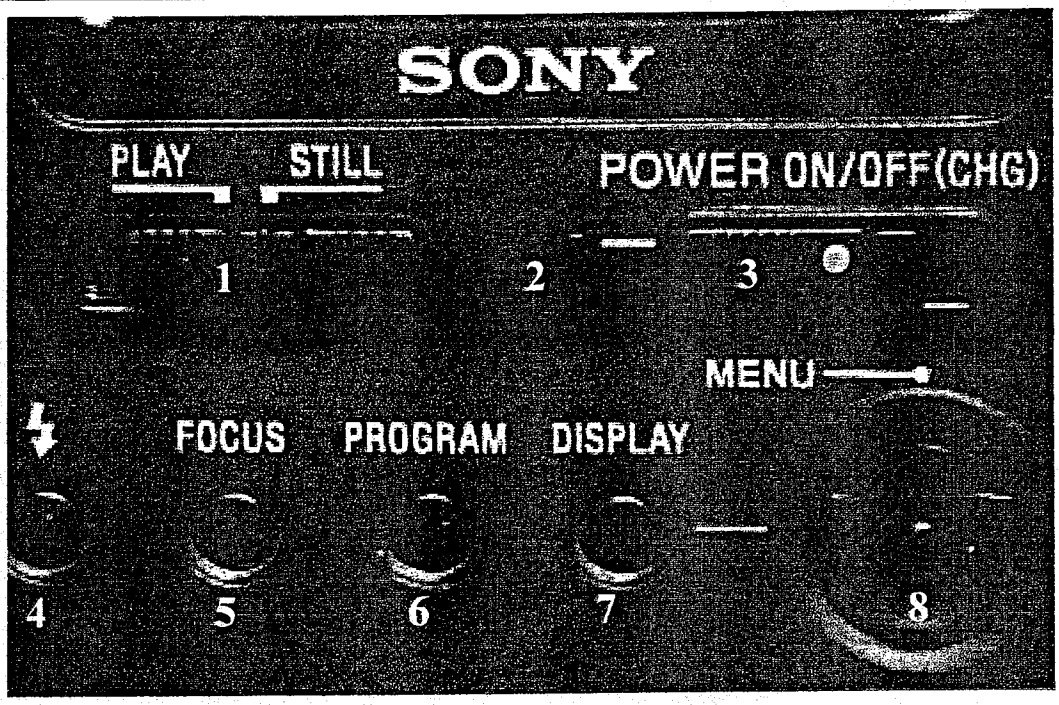
9.41

DIGITAL CAMERA
BACK CONTINUED



1. PLAY/STILL SELECTOR – Pictures are taken in the Still mode and reviewed in the Play mode.

2. POWER ON/OFF (CHG) LAMP – Lights up green when the camera is turned on and orange while the battery is charging.

3. POWER SWITCH – Slide this to the right as the arrow indicates to turn the camera on and off.

4. FLASH BUTTON – Turns the FLASH mechanism on and off. A prompt will appear in the upper left corner of the LCD if the flash is on.

5. FOCUS BUTTON – Macro focus can be selected using this button.

6. PROGRAM AE BUTTON

7. DISPLAY – Several messages can appear on the LCD. This button will remove these messages or let them show as desired.

8. MENU/CONTROL BUTTON – This button has 4 arrows and is used like a cursor to open menus and make selections. Pressing the center straight in finalizes a selection.

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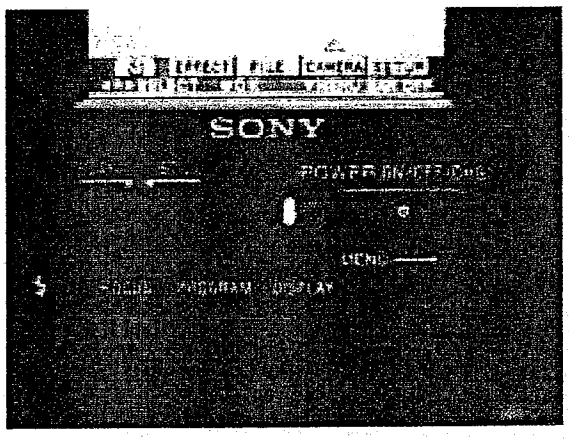
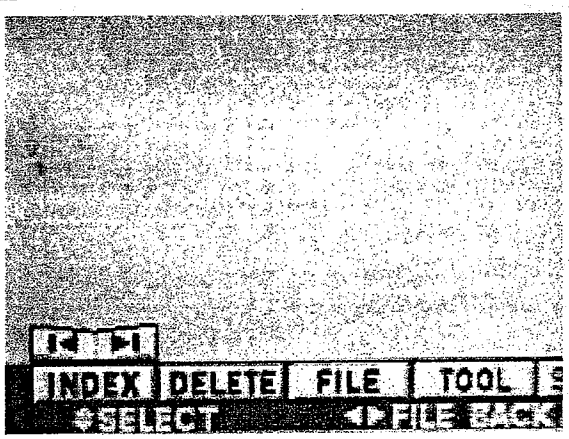
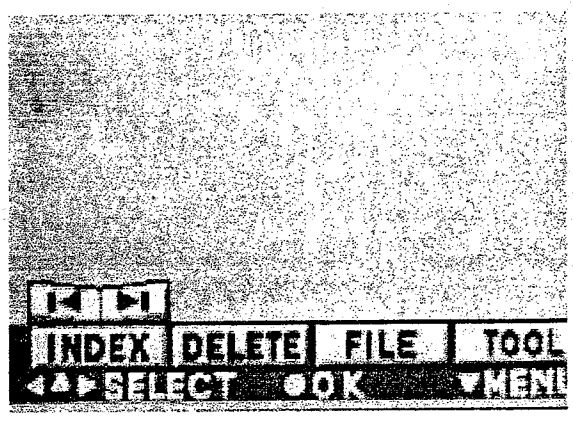
9.42

DIGITAL CAMERA
MENU/CONTROL BUTTON

	The **Control Button** is used to select the buttons, images, and menus displayed on the LCD screen and modify settings. Pressing the upper arrow displays the menu bar. Pressing the lower arrow clears the menu bar from the screen. Note: the menu bar changes depending on the position of the Play/Still selector.
	Press the up/down left/right arrow on the control button to select the item you want to set or the image you want to display. The color of the selected item or the frame of the selected image changes from blue to yellow.
	Press the center of the button to enter the item. Repeat both steps to execute each function.

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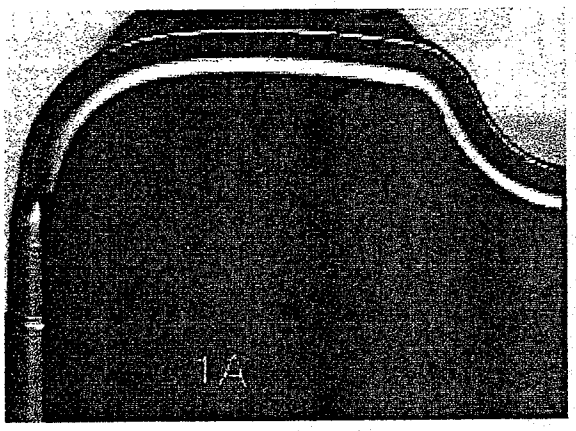
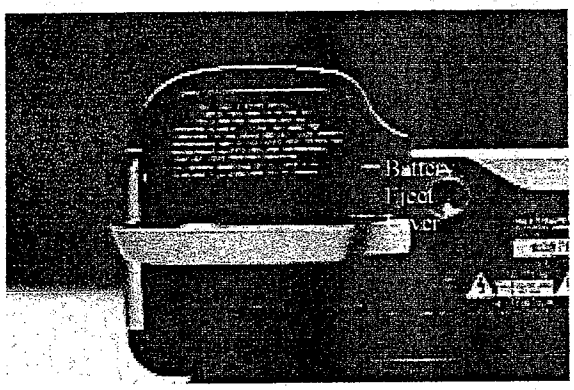
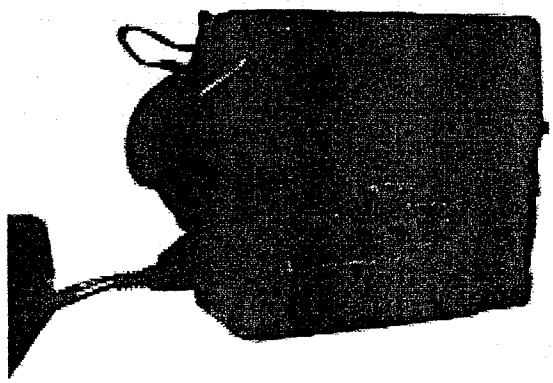
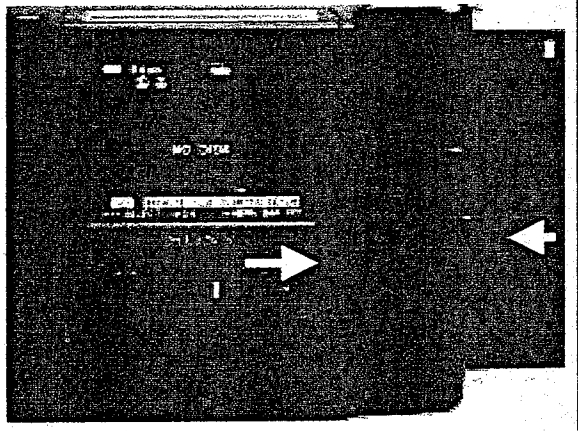
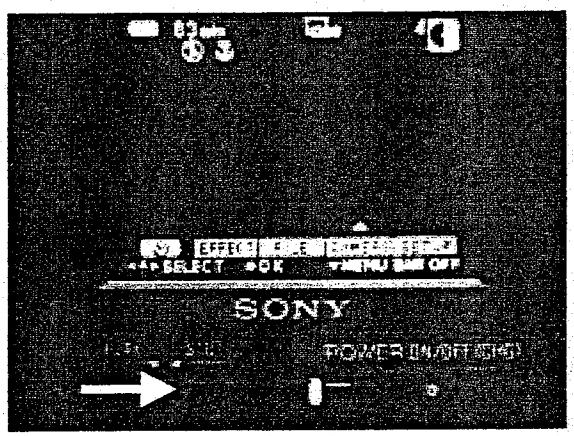
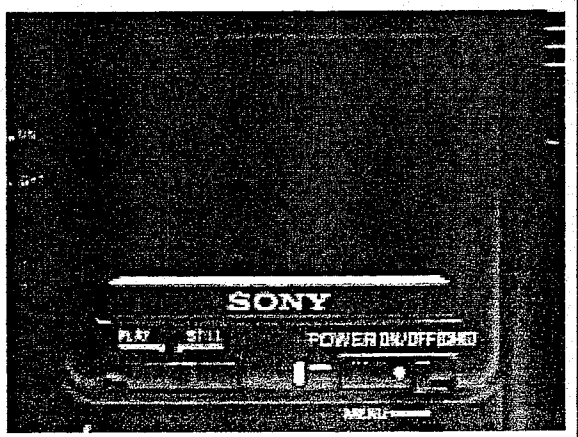
9.43

DIGITAL CAMERA
BATTERY

	Slide the battery cover in the direction of the arrow to open.
	Install the battery pack with the arrow facing toward the compartment. Close the cover. Slide the battery eject lever to the right when removing the battery pack.
	With the battery pack in the camera, open the DC IN cover and connect the AC power adapter to the DC IN jack of your camera with the arrow facing up. The power on/off (CHG) lamp lights up orange when charging begins. The light goes out when full charge is complete (~150 min). The Battery Remaining indicator is shown on the LCD screen.

DIGITAL CAMERA
RECORDING IMAGES

	Remove the lens cover. Slide **Power Switch** to the right to turn on power. Insert a floppy disk until it clicks.
	Set the **Play/Still** selector to **Still**.
	You can turn off the indicators on the LCD screen by pressing the Display button. A clear screen will enable you to compose your picture without obstructions on the screen.

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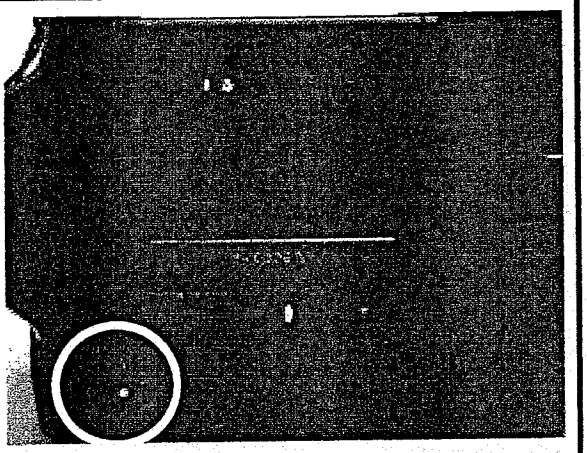
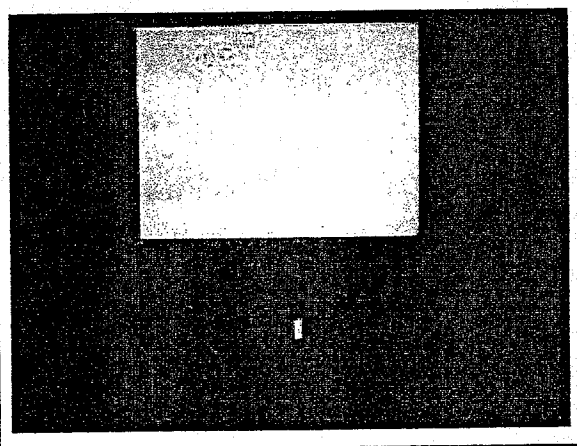
DIGITAL CAMERA
RECORDING IMAGES



Is there enough light? If not, adjust the lighting or use the flash. Note: using the flash on close-ups will wash out the image.

Frame your subject and focus. Adjust zoom if you cannot get a sharp focus on a close subject. You may have to use the manual focus Macro setting (looks like a tulip on the LCD) for extreme close-ups. Press the focus button for this setting.



Press and hold the shutter button half way down. The image is frozen and the camera automatically adjusts exposure and focus. When the small green light stops flashing, the camera is ready for recording.

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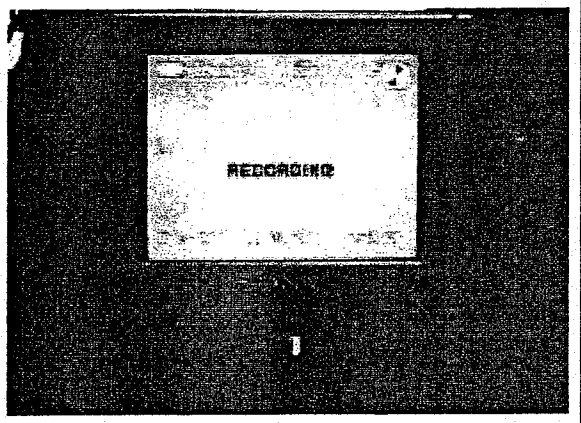
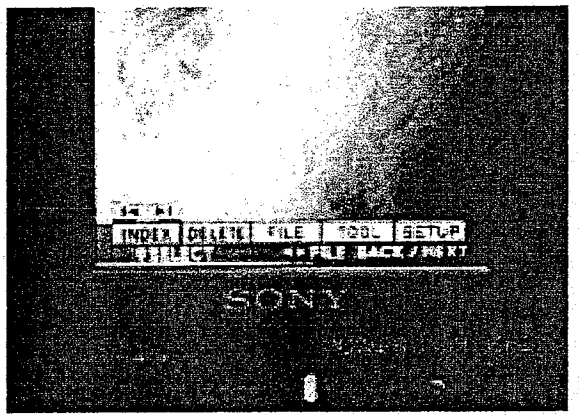
DIGITAL CAMERA
RECORDING IMAGES

	Press the shutter button fully down. When "Recording" disappears from the LCD screen, you can start the next recording.
	To play back images, set the PLAY/STILL selector to PLAY. The last recorded image appears on the screen.
	You can edit pictures as you take them, deleting the unusable ones, or you can edit a series of pictures when you are finished capturing images. A disk will hold approximately 6 images at the 1280x960 size (keep the setting here for the highest quality) so you may want to get rid of the unusable ones as you go to free up disk space.

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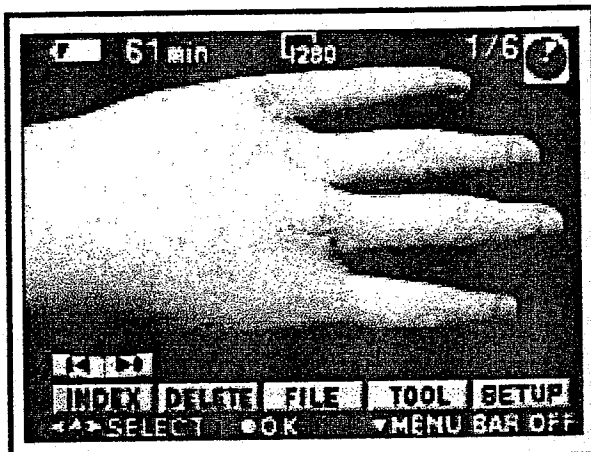
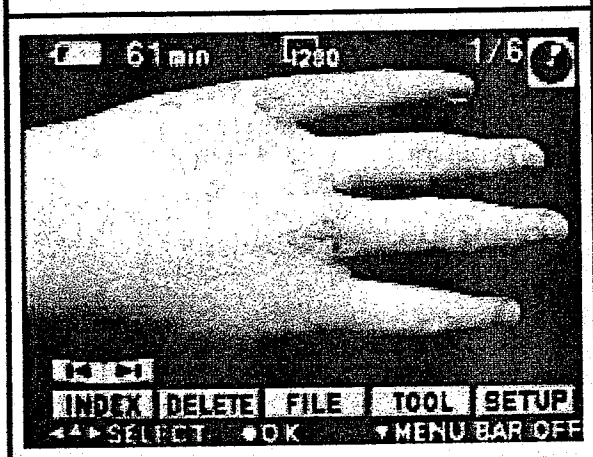
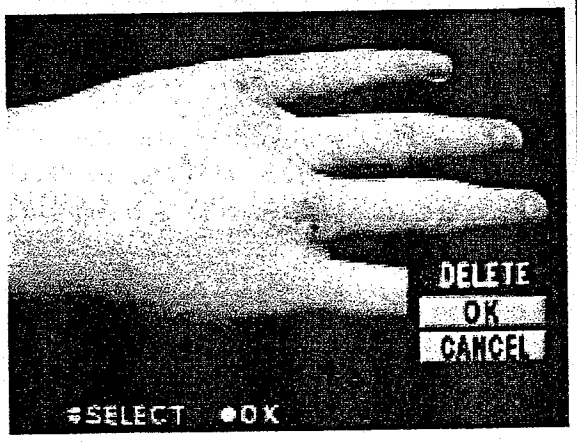
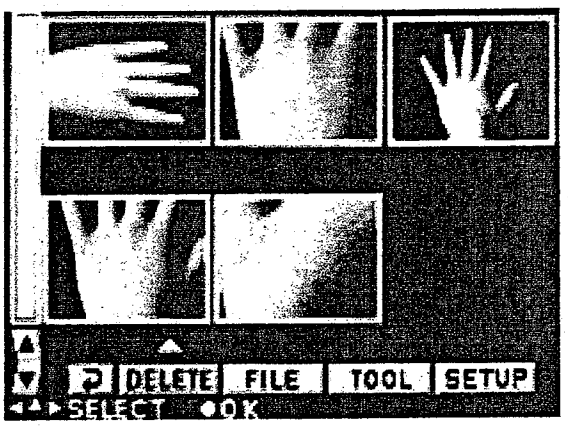
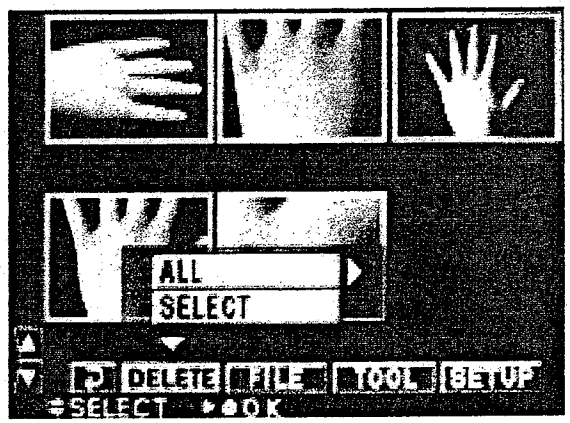
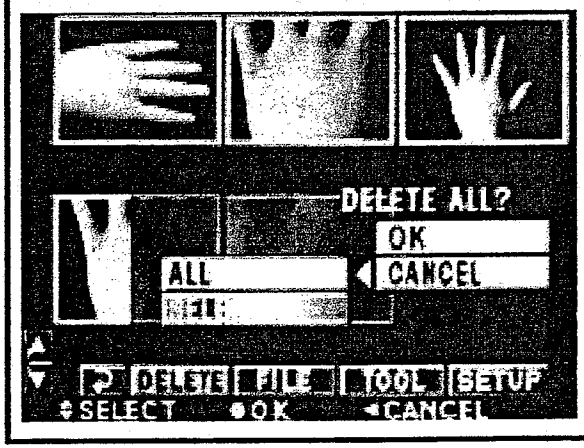
DIGITAL CAMERA
DELETING IMAGES
SINGLE MODE

	Set the **Play/Still** selector to Play. Display the image you want to delete. Press the center of the Control button after you make your selection.
	Select **DELETE**. Press the center of Control Button.
	Select OK. Press the center of the Control Button. The image is now deleted.

ATS v.6 is funded, in part, by the National Library of Medicine NO 1-LM-6-3540.

9.48

DIGITAL CAMERA
DELETING IMAGES
INDEX MODE

	Set the **Play/Still** selector to **Play**. Display the **INDEX** Screen. Select **DELETE**.
	Select **ALL** if you want to delete all images from the disk, or **SELECT** from the menu if you want to chose individual images to delete.
	Press the center of the Control Button to make your final selection.

ATS v.6 is funded, in part, by the National Library of Medicine NO 1-LM-6-3540.

9.49

VIDEO OTOSCOPE
SKILLS LIST (Draft 03/01/00)

	Pt. 1	Pt. 2	Pt. 3	Pt. 4	Pt. 5	Pt. 6
VIDEO OTOSCOPE QUALITY CONTROL						
Turns on equipment and waits for light change to indicate warm-up						
WHITE BALANCE completed:						
• 1 – 2 inches from unbleached calibration sample						
• 3 second color balance						
• Monitor image equal to calibration surface						
BRIGHTNESS adjusted to full brightness						
FOCUS						
• Tip of scope cleaned						
• Outside ring of monitor image assessed for sharpness of focus						
• Cupped hand or print used to sharpen focus						
(If otoscope head is replaced for this examination, focus camera prior to replacement)						
FIRMLY ATTACHES SPECULUM (if not previously done)						
PATIENT POSITIONED and COMFORT ASSESSED						
• Patient positioned to permit examiner view of monitor - Consideration given to positioning patient to view image						
• Provider seated or otherwise positioned to permit flat angle of entry						
EXTERNAL EAR EXAM CONSISTENT WITH CHAM						
• Notes redness, swelling or tenderness of mastoid area						
• Notes discharge						
Notes tenderness with manipulation of external ear						

9.50

INSERTS TIP OF OTOSCOPE INTO EAR CANAL • Observes as tip of otoscope enters canal – no blind insertion						
• Flat angle of entry maintained						
CANAL EXAM CONSISTENT WITH CHAM • Notes redness, swelling, discharge or patient discomfort						
• Notes cerumen that may obscure view - Removes cerumen in accordance with CHAM						
TYMPANIC MEMBRANE EXAM CONSISTENT WITH CHAM • If unilateral ear problem reported, examines opposite ear first						
• Visualizes entire TM						
• Notes color						
• Notes transparency						
• Notes position						
• Notes mobility						
CAPTURES IMAGES						
IMAGES EVALUATED FOR CLINICAL ADEQUACY • Is entire TM visible, with one or multiple images?						
• Do images support assessment?						
• Are enough images saved to demonstrate concerns?						
IMAGES CORRECTLY LABELED						
POOR IMAGES DELETED						
ASSESSMENT DOCUMENTED ON ELECTRONIC PEF						
CASE TRANSMITTED OR STORED						

SHUT DOWN						
• Speculum removed and properly disposed						
• Otoscope tip cleaned with alcohol or other broad spectrum cleanser						
• Monitor image evaluated to assess adequacy of cleansing						
• New speculum placed for tip safety						
• Otoscope returned to holder to prevent damage						
• Video otoscope turned-off if greater than 10 minutes between patients is anticipated						

Summary of Focus Group Responses

for the

Alaska Telemedicine Test-bed Project

Kaerin Stephens

September 27, 2001

INTRODUCTION

The format of this summary presents (1) a question in bold type, (2) a review of the main points of each focus group including quotes, and (3) a preliminary analyses in bold type. Speakers are identified "CHA#" for Group 1 and "HA#" for Group 2. Five health aides from four communities form Group 1 and seven health aides from seven communities form Group 2. The summary is organized into six sections: introduction, the training process, experiences, applications, critiques, and conclusions that address a variety of perspectives from health aides about telemedicine in their communities.

Q1: What do you think of when you hear the word 'telemedicine'?

Group 1: Looking at ears (CHA1 and CHA4); taking pictures and sending it to the doctor (CHA3 and CHA4); a "big black telephone" and communication (CHA2); and computers (CHA3) come to mind when the health aides hear the word telemedicine. CHA5 agreed with the others.

Group 2: Computer (HA9); "What now? What are we getting into?" (HA8); ears and skin (HA10); images eliminate difficult descriptions; takes some pressure off health aide; and helps doctors (HA7) are what come to mind when the health aides hear the word telemedicine. The other health aides had nothing more to add.

Similarities between the two groups include references to computers, ears, and taking pictures for doctors. This kind of question is an easy opener and also indicates what is uppermost in most group members' minds regarding the main topic. The common overlap shows that we are all "on the same page."

THE TRAINING PROCESS

Q2: What was the training process or learning process like for you?

Group 1: Two health aides (CHA4 and CHA2) would have liked a longer period of training. CHA2's perception was that "they came and trained us in one day what they had been working on for years." They felt a week-long course would be more effective and they could learn more efficient ways of working with the equipment. CHA2 remarked, "I'll go the long way and that's hard for me...and then somebody else (will) come along and say, 'Oh, this is all you gotta do.'" Most of the health aides agreed with her including CHA3.

CHA2 (the eldest member of the group in her mid-50s) liked the ability to send pictures but was frustrated with writing an extra description to accompany the picture - several health aides agreed with this including CHA1 and CHA3. CHA4 had trouble using the digital camera and was confused about computers, she had never been trained on a computer. CHA4 refers to the regional hospital's computer system ("it's Greek too") which is separate from the telemedicine system and CHA2 agrees with her. They don't clearly distinguish between different computer systems.

CHA4 was afraid of "breaking" the digital camera but she was glad the other CHA in her village (CHA3) learned how to use it. CHA5 also remarked that she had problems with the digital camera and there was no training for that. CHA2 added that she had to learn how to use the digital camera "the hard way, too." CHA3 said she didn't have problems taking pictures with the digital camera but had difficulty saving and pulling up the pictures on the computer. CHA4 also "lost a lot of things" and was disappointed when

she had something good to send but couldn't locate or "pull" it up. CHA4 also expressed difficulties accessing her e-mail on another system.

CHA2 thought the telemedicine system was good technology but doesn't feel "literate" in it. CHA2 valued the ability to send a picture and ask for a doctor's opinion on rash cases. CHA1 brought up her problem with batteries losing their charge after long periods of no use. Getting off the topic of training, CHA3 brought up the big problem of not being able to send anything out (including e-mail) on their communication lines and how that makes all the expensive equipment valueless.

Group 2: HA6 opened by saying that the training process was one of

> Curiosity, like the challenge of learning something...and you know it's gonna be (helpful) for the patient, not only the patient but the doctor and ourselves.

HA8 added :

> It took me a while to learn how to do this and that and (laughs) but it was fun at the same time (to) try and learn...(our teacher) was making it fun, that's why we learned so fast on the computer.

Several of the health aides in the group nodded in agreement that this trainer who has been involved with training health aides since the 1970s was a key element in the success of their learning how to use the telemedicine equipment.

Two health aides (HA7 and HA8) acknowledged that they were new to computers, but each had a different training experience and attitude. HA8 (in her mid-forties) who spoke above was included in the original training:

> When I first started, I thought I would never learn 'cause that was the first time I go on computer and try to do this, these different things, so it was kinda hard for me at the beginning.

Conversely, HA7 (in her mid-60s and the eldest health aide in the group) missed the original training because she was having surgery in Anchorage.

> We never have training, they just ah, train us on the phone, and it was kind of hard for us[1]...I'm very slow to learn, so I didn't get to really know how to use that...the younger ones use it, 'cause I'm not very good in that computer...[2]

I encouraged health aides to tell me what was most difficult for them to master and they had several responses. HA8 who eventually learned to use the equipment said:

> The hardest part for me was trying to take a picture of the ear of a small baby, try to keep 'em still, I don't have much patience so I was kind of, was straining sometimes.

HA11 said:

> The hardest part I had was when, after I take everything, and then I lose the pictures and the patient is gone (several people laugh and nod as they identify with her frustration).

HA12 contributed:

> For me, I guess the hardest part was the trying to do the descriptions to the doctor, you know, type it up and try to tell the doctor what was wrong with the, you know, to focus on that picture, that was real hard for me.

While all of these difficulties passed with time or became less frequent, HA10 later added: "It's hard when you just train one person and expect them to go train everybody else."

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[1] Note that traditional communication among many native Alaskan groups de-emphasizes the individual, hence the use of "we/us" where Anglo-Americans would use "I/me."
[2] Conversely, the first person singular used here acknowledging personal limitations that do not extend to the group.

At this point, the discussion diverged into how the NLM equipment compared with the more recent AFHCAN equipment, i.e., the touch screen. The comparison resurfaced several times throughout the discussion and is summarized in another section.

No single statement can generalize the health aides' experiences with training on the telemedicine workstation. Perceptions of training varied widely within and between groups because there were

(1) **two or three different trainers in each region with different presentation styles and types of relationships with the health aides,**

(2) **some health aides who weren't able to participate in original training,**

(3) **health aides who varied in their prior experience with computers,**

(4) **disagreements whether the length of training was sufficient or not, and**

(5) **varying attitudes among health aides toward change and technology (curious about new technology, open to challenge, more comfortable with "old ways").**

Striking differences between the focus groups are listed below.

(1) **The majority of Group 1 repeatedly expressed difficulty learning how to use the digital camera and Group 2 didn't mention this as a problem at all.**

(2) **The majority of Group 1 expressed the need for a longer period of training and Group 2 didn't suggest this change.**

(3) **Some members of Group 1 sometimes conflated the problems of other computer programs with those of the telemedicine system.**

(4) **The majority of Group 1 expressed discouragement with trying to send images when the communication lines weren't functioning whereas Group 2 did not (although they had times when servers were down).**

(5) **Some members of Group 1 expressed frustration with the extra quantity of writing that accompanied the picture whereas one member of Group 2 expressed difficulty with the act of typing and providing a different kind of description to the doctor.**

(6) **Despite the above problems, Group 1 expressed that they valued the telemedicine equipment for its ability to send pictures to the doctors.**

The most obvious similarity between the two focus groups is the mutual expression of frustration at "losing pictures," that is, not being able to "pull up" or "find" an image that was saved or was believed to be saved.

Q18: What advice do you give (or have you given) other health aides about the telemedicine system?

Group 1: Only one health aide in this group (CHA5) had the opportunity to train another health aide, and at that time they weren't able to send pictures. For CHA3 and CHA4, their itinerant trained with them and they said he was more proficient using it than they were. For CHA1 and CHA2, the itinerant health aides already know how to use the system. For these four health aides, there have been no new staff come since the system was set up.

When CHA5 (the youngest member of this group) showed the new health aide, she said she

> [W]alked them through what Denise and Heidi walked us through while taking pictures and putting in information lie which side the ear is, the mobility, and then the rate of (unclear) and then the consent forms...but we don't send information when we can't.

CHA5 said she spent maybe 15-20 minutes teaching the other health aide who knew "how to work the computers," and then said, "Try to do it yourself."

Group 2: One health aide was able to guide other health aides in sending a picture over the telephone (HA6). A few months after they had been trained, she went to visit her parents in another village,

> Just when I reached there, I got in the house, they called me from clinic…they need to send a picture, how do they send a picture? (several of us laugh) And so I talked to them over the phone, they knew how, they just needed confidence and which direction to press the buttons…they did okay.

When she returned, she kept showing them, "do this way, do this way, and go here."

Another health aide (HA10 – the youngest of the group and mother of six) chimed in: "Everyone depended on me to do the telemedicine." She indicated that it was easier to do it than train others to do it. HA8 said that she helped train two new health aides; one was hesitant and one was eager, but both learned how to use the telemedicine equipment. She said that the system (lines or server) was down a lot so it was hard to show them the whole process. One health aide (HA11) said that she let the other health aide teach the new trainee.

When I asked HA7, the eldest health aide, if she had ever given any advice about the telemedicine system to new health aides, she said

> I'm scared of that computer, I'm scared…years ago (another health aide) used to, 'Here,' she try to give me the mouse, I was so nervous… You know what, I was so nervous, I didn't want to touch that mouse (lots of laughter from the group). She say, 'Here you try it, someday you'll try to use it.' 'No, I'm not gonna touch that!' (more laughter from the group). Yeah, the younger ones are pretty good, I mean that girl…she knew how to use that new one…So, I'm not a good teacher…but I can read my e-mails, open it, and that's about it, I don't know how to type either. I just use my one finger, that's it to type. I'm not like this (imitates typists), I just use my one finger…See how that is, life is that way, we're not city people, we're village people, right? (laughs).

HA9 suggested that "maybe it's easier for younger people, 'cause you know, technology...when HA7 (started), there was no electricity." HA7 noted that they got electricity in her village sometime in the 1970s.

Then HA10 (the youngest health aide in the group in her late 20s) said:

> I remember feeling how HA7 feels when we first got computer, I was scared too, 'cause when I did play around with it something would happen and I wouldn't know how to fix it...it happened once, I just kind of backed out for a while and told 'em, 'I don't know what I'm doing with this computer' and so they let me go through that basic training, computer training and that's all I had and then I had to just learn on my own after that...I got it to go full screen and I couldn't figure out how to make it go small (laughs).

HA8 also shared how

> [T]he other health aides knew how to use the computer 'cause they went through college and...had computer training...It was really hard for (me and another health aide) to get used to that computer, each of us (laughs) trying to let us learn how to use that mouse, and was, 'Oh my goodness, what can I do?' Try to go over and (the trainer) saw how I was holding that mouse and tried to really control it, and he said, 'No, relax (laughs). Just relax your arm.'

HA9 brought up another humorous story about changing technology when her mother-in-law was a health aide and in the 1970s they changed from using CB radios to the telephone. Her mother-in-law continued to say, 'Over,' and 'Do you copy?' when she finished her sentences on the telephone. Everyone laughed and she finished saying: "That's how we had to talk...so and now, we're just, the tiny little arrow."

The only similarity between the two groups' comments regarding training others is that it's difficult to train when lines or servers are down; so health aides can only demonstrate how to take images but not how to transmit them to trainees.

The above responses make up an engaging series of stories on how health aides transfer their knowledge of computers and telemedicine technology to one another. The first group has had less staffing turnover and only one short tale emerged that I call: "Try it yourself."

The second group relayed a series of five personal stories along with a mixture of insights about the ease or difficulty of training others. The first story, "They just needed confidence" is about one health aide telling others how to send an image over the phone. The youngest health aide identified with that story in that the health aides in her village all depended on her to handle the telemedicine cases. "It's easier if you do it (yourself than train them)." Age is an important factor in determining roles in native Alaskan societies; it isn't the norm for younger health aides to act as teachers to their elder co-workers (and often relatives).

The second, third, and fourth stories mingle together around confronting fear of computers and the mouse. The eldest member of the group talks about not even wanting to touch the mouse, but she admits she can open her e-mail and answer it with one-finger typing. At least half of the health aides revealed that they use only one or two fingers to type. The youngest member responded that at first, she was afraid of computers too but asked for more training and learned a lot on her own. A middle-aged member also states that she was very tense the first time she used a mouse and had to be encouraged to relax by the trainer. Interspersed amid this trilogy of computer-phobia were references to the 1970s when some villages didn't have electricity. This section closes with a humorous account, "Do you copy?" about how a former health aide made the transition from CB to

telephone communication and how some health aides view the "little arrow" on the screen as a similar leap to make.

Q.20: What do you think is the best way to learn? How can training be improved?

Group 1: All the health aides agreed that hands on experience was the best way to learn to use the equipment. CHA2, CHA3, and CHA 4 agreed that one week's training time in the clinic would be enough to learn how to solve the problems they'd been having. I asked them about the manual and CHA5 said it's okay when you have the time and here they launched into a myriad of their responsibilities: making travel arrangements, phone calls from the hospital about medical records, specialty clinics, monthly reports, lab word, controls, ordering supplies, and updating policy manuals.

The training of new health aides can be improved through standardized training. CHA2 doesn't want the responsibility of training others and CHA1, CHA3, and CHA4 agreed. They were concerned that "not everybody's a good teacher" and they feel like they are too busy. I got the impression that they didn't have enough confidence in their grasp of the technology to teach others how to use the system.

Group 2: This group has been trained twice on two telemedicine systems, once by the NLM project in the winter of 1999 and then more recently in the spring of 2001 by the AFHCAN project so health aides made frequent comparisons between the two.

HA8 and HA10 said they needed more time for training. HA8 stated earlier that she didn't have much training on the new one and HA9 added that in her village,

> [T]hey didn't stay too long...that guy come up and train us on the new one, he was worried about missing his flight to Anchorage from here, he was there only up for two hours...and trying to catch the next plane out, same time talking to us, telling us how to do stuff. A lot of that was we had to get into it ourselves.

Conversely, HA10 remarked

> We had better training on the new one than the old one, 'cause (the old one) they showed me how to do it and then I had to go back and show everybody else and they didn't, they just depended on me to do all the telemedicine cases. But this new one, they showed each one and then each one tried to, so the new one was easier for me because I wasn't doing all the cases (laughs) 'cause they would, 'We need her to send a telemedicine case,' and they would come and get me to do it, so for me it's a big weight off my shoulders.

HA12 responded to HA10:

> For us, it was visa versa and we're all into that old one, we can all get into there, but with that new one, we designated one, the youngest one, 'cause she, she knows more about computers than we do.

HA9 suggested that health aides and doctors be trained together so "we hear the same thing and see the same thing and understand the same." Later she added,

> Maybe not (us) coming down here (to the regional center) but having the doctor come up there, so they could also see, 'cause not every doctor gets to see what it's like in the village.

One important strategy in training health aides is how to manage the village clinic while health aides are learning. Other health aides agreed with HA6 when she said:

> The first time when they did training, they had somebody come from someplace and see the patients while we do the training, and this time around, they want us to close the clinic and try to do the training, but that didn't work because people still come in...(it was better)...to concentrate on that thing and stuff.

In an earlier section, HA6 mentioned that she missed the old (NLM) telemedicine system and began to compare how they were trained on the new system,

> In our clinic, even though we put a 'We're not open 'til 2 o'clock' sign, people still come in and want this and want that...The (trainer) stayed...overnight but still I feel that it wasn't enough time, 'cause we were busy, busy.

HA10 agreed:

> That happened to us too, 'cause we would take turns going out and seeing patients even though we were closed and we announced that we were closed..."

When asked about the manual, the eldest health aide said it was good and others agreed that it helped. HA12 remarked "The old one was easy to follow." Then, the discussion got off topic as some health aides began to talk about their new training on the EKG component, "but we still can't use it."

The most obvious similarity is that both groups desire more time training on the telemedicine system. Most health aides received two to three days of training on the NLM project, however, one health aide recalls only one day of training. Both groups also indicated how busy they are in the clinics and that the training manual was helpful and easy to use.

Most of the members in Group 1 stated a preference that trainers stay in the clinic about a week so that they can get hands-on experience with patients as they come in whereas most of the members in Group 2 prefer that the two or three day period of training not be interrupted by patients and other duties.

Health aides in the village clinics have different statuses according to seniority and age. Group 2's discussion illustrates that in several villages, one health aide - often the youngest - is informally dubbed, "the telemedicine person." The "telemedicine person" may perceive this as an honor or a burden. Future trainers should be aware of this trend and not depend on the one quick student to be

able to pass on the training to others. Most of Group 1 agreed that not everyone was a good teacher and advocated standardized, hands-on training for every health aide. The youngest member of Group 2 said "It's easier if you do it (...than have to train), the oldest member stated earlier that she didn't consider herself to be a good teacher, and other health aides deferred to others when new health aides needed training on the telemedicine system.

In my conversations with CHAP directors, I have the strong impression that management expects experienced health aides to informally pass these skills on to novice health aides. There is resistance to this among some health aides who feel overburdened by their job duties and lack confidence in their own computer and telemedicine skills. If management wants health aides to take the initiative in training others, then building the health aides' confidence should be a top priority.

One last suggestion that was met with general interest in Group 2 advocated including doctors in the health aide training sessions on telemedicine equipment. Advantages would include introducing doctors to the village environment and being on the save "wavelength" with regards to the technology as the health aides. This could be a positive step toward improving communication between the health aides and doctors.

10.14

Q3: Was there anything that surprised you when you first started using the telemedicine system?

Group 1: The biggest surprise for most of the health aides in this group (CHA2, 3, 4, and 5) was the lack of enthusiasm, interest, and response from the regional medical personnel.

> The thing that surprised me was that it seemed like that people in (the regional hospital) were not as enthused about it as I thought they should be (CHA2).

Some had gone through the effort to take a picture of a broken arm or an ear drum and wanted some guidance and there was no response. CHA5 said:

> It felt like they didn't have, you know, time for us or time to look in the computer.

CHA4 and CHA2 suggested that the region have a central communication room to make it more convenient for the doctors. CHA2 and CHA3 were brainstorming how the pictures and patient encounter forms could be attached to each other when CHA1 told them how she wrote "sent by telemedicine" on the bottom of her patient encounter form and that worked well for her. CHA3 had high hopes for the telemedicine system - preventing unnecessary trips, saving money, doctors being able to see what health aides see - that were dashed when the communication lines failed and nothing couldn't be sent out.

Group 2: HA7 noted that mothers of children with ear problems often showed surprise at how the ears looked on the monitor. HA10 was surprised at how different the color of the ears looked using the fiberoptic otoscope:

> I noticed when we use our otoscope (the ear) looks red, but when we used the telemedicine, it really don't look red at all...it doesn't look infected, I don't know if it's the light being so bright and ours being dimmer or...so it kept us from treating ears that were really not infected.

After a long silence, HA6 spoke out,

> I think the trainers that train us to know what to expect.

In addition to the perception that trainers prepared the health aides well, it appears that trainers in this region didn't raise false or unrealistic expectations among the health aides, such as "This is so easy" or "This is a very simple system."

[It is common for people in focus groups to answer some questions before asked and conversely, to return to earlier questions as the interview progresses. I refer back to earlier passages for the first kind of split information. As for "late" responses, I place them with the questions that they best answer. Additionally, groups may focus on important issues in response to different questions. In this preliminary analysis, I inform the reader of this disjuncture in footnotes.]

A late comment from HA9 brought up an unpleasant surprise for some members of Group 2. She said, "I'm surprised that we still send patients down for ENT" to which another health aide (HA10) responded:

> I don't know if we're supposed to go through that, uh, 'cause, 'cause (our village) has a lot of ENT patients. And they were gonna do that where we just take a pictures and follow up instead of having the patients coming out (to the regional center) and do a, maybe 5-10 minute follow-up and then go back home.
>
> They were gonna have us do the pictures and let the doctors see it, but we never did. We never did that...No, they never did let us take pictures of the patients for follow-up after ear surgery, they never did, they said it was a year ago. Last year in March, or something like that, but then they never did.

Then HA9 replied:

> I'm just curious 'cause by now I would think that it would be established where we would just take a pictures of the ears or the throat or whatever. Just like how the doctors, the ENT doctors, look at the ears and throat and send 'em home and say "You're fine" or whatever. But it's not established yet and that's our biggest problem I think, ENT our largest patient load (some coughing in background). I thought in the original plan, 'cause they chose ears as the first test thing, that it would be something that would eliminate travel or at least for the, a few people, not everybody, some people.

Another "late" comment involving a surprise came close on the heels of the above discussion on ENT. This case by HA12 shares both an element of surprise and a positive experience (which had been the question).

> We had one (positive case) in our village, he had a deep, ah, what do you call that, ah, a deep cut on the shin. Every week he was on a different kind of medicine that we have to change every week, every week he'd come in, but we'd pull out a picture and measure it (unclear) every week just to make sure he's getting better.
>
> We were surprised to see...(that) he didn't have to travel. We did the treatment up there, (with) telemedicine and according to the doctor what it looked like, then that was (unclear)
>
> [When you said they were changing the medicines, were they changing different antibiotics?]
>
> Not the medicine but the dressing that we used. He had to come in for a weekly change.

The "surprise" question explores experiences that health aides had without leading them along "positive" or "negative" routes, as Question 4 and Question 5 do. The two groups have very different kinds of responses to this question. The majority of Group 1 was unpleasantly surprised when doctors on the receiving end were unresponsive.[3] One health aide who was optimistic about telemedicine was

[3] Group 2 addresses the problem of doctors not responding when asked about negative experiences (Q5).

disappointed at times when the communication network failed. Fewer members of Group 2 initially responded, but those who did reported more pleasant surprises: mothers were pleasantly surprised and engaged, better quality of color from the fiberoptic otoscope, and praising the trainers for preparing them well.

During later questions, however, two members of Group 2 discussed an unfulfilled expectation they had concerning some kind of protocol for doing ENT follow-ups in the village using the NLM telemedicine system. Another member discusses how the health care aides in her clinic provided extended follow-up care for a man's wound that allowed him to stay in the village.

Q4: Tell us (a story) about a positive experience that you had with telemedicine in your community/village?

Group 1: All of the health aides in this group agreed that showing people the insides of their ears was a positive experience that they had with telemedicine and connected with this was the opportunity for patient education.

> I think, ummm, you know the patient getting to see their ear, if they're coming in with an earache and then their ear turns out, you know, they think they have an ear infection but they have serous otitis, you could use the picture to, umm, educate the patient about what's going on. I think that was, you know, people like that too, you know. (CHA5)

CHA3 said her best experience with telemedicine was taking a picture of an abscess and learning that it was cellulitis.

> The other thing is taking a picture of really cool, up close abscess and it didn't, it looked like an abscess but I think when we sent it down, it was umm...cellulitis. It looked exactly like a big abscess, they sent it and the doctor looked at it...a really nice, cool picture. (That was my) best experience.

CHA3 also remarked on taking pictures of arthritic joints. CHA4 said that her most

positive experiences were having patients watch as she cleans out their ears, "they really get excited about that." CHA2 said her best experiences included being able to follow the course of eczema in children. CHA2 also stated that she had been able to identify normal variations in ear drums and has done a lot of healthy ear checks especially with young children to introduce them to the new tool.

> I can't think of anything right now that really sticks out on my head but it was, I had a lot of people just come in and I just, I would just show them their ears, you know, didn't necessarily document it all but just show them their ears so that they could know. And little kids, try to get them accustomed to being able to sit still and look in there and see something that's interesting...If you bring them in when they're well, they're more likely to cooperate when they're not well.

Group 2: HA6 answered first by telling the "Holy Cow story" which is well known in the region, mostly for it's humor. Several members of Group 2 told humorous stories; what follows is the funniest.

> When they (the telemedicine equipment) first came out, I was working at (another village) and um, (the health aide there) saw a patient then, had an allergy reaction to something and her skin was all red.
>
> And (you) know how we write it out on paper and fax it in to the doctor? I don't remember which doctor but she said, 'Can you send pictures?' I think that was, you know, the first few months (it) was up, so I helped (the other health aide) take pictures and send 'em down.
>
> And she was worried about that patient as soon as we sent them down, I told her, 'We sent 'em down' then she said, 'Call the doctor.' So we went to the other room and called the doctor, tell her 'This is the village clinic, where we sent pictures already.' She say, 'Okay, let me pull 'em up.' She was still on the phone trying to pull em' up.
>
> She...I sit there and listen and (the other health aide is) like standing right there, she wanted to know what the doctor was doing. I tell her she is pulling up the pictures and listening and waiting and the doctor said, "HOLY COW!" (laughter from the group)
>
> And I laughed and she started to say, "What?" And I tell her, "She say the cow is holy" (Lots of laughs). Then that really cracked us up though. But

she's, the doctor said for the patient to come down, and evaluate down there (at the regional hospital). But that was a funny thing.

The next health aide to speak told of a positive experience with their new system. After she finished I re-stated the question "any other positive experiences with the OLD (NLM) telemedicine?" and HA9 spoke:

I was involved when they were first getting the program started and that was pretty exciting to see that (clears throat) we can have that kind of stuff in the villages.

It was exciting but then it was also scary that you know we would have more health aides more doing computers than spending time with the patient but I guess that really didn't happen, they still work closely with their patients.

'Cause we go to Anchorage and we go to the doctors down there and they spend time you know they ask questions while they're typing on the computer and they hardly look at you. And we were afraid something like that would happen and change the ah, perspective of the health aide or how they patient will see the health aide, but this is a tool that really helps, I think.

In (our village), we use it for even when we have assault people like for the...take pictures to see the VPSO (Village Police & Safety Officer) or the troopers will need evidence or whatever.

Just I guess it just takes some of the pressure off describing and the doctor could see with their own eyes and we don't have to convince them over the phone.

Then HA6 remembered another case involving telemedicine that had a positive outcome:

There was a boy that got hit by a (gun) shell, or somebody was shooting a 22, and it didn't fire right and piece of the, piece of the shell hit his eye and like lacerated it a little. So we took a picture of it and when they got it here (at the regional center), they forwarded it down to Anchorage and so that helped the patient. He ended up going all the way to Anchorage too, but his eye was saved...[So he was...because of the picture, he was sent to Anchorage sooner?]...They would have (sent him to Anchorage anyway), but it, it helped them (in Anchorage) prepare, to know what's coming instead of just description and words, they had like, the actual photo of what it looked like.

At this point, HA9 responded to the previous question about surprises (see Q3 regarding the conversation between HA9 and HA10 regarding ENT cases). Then HA12 remembered a particular case that surprised her (see Q3 about monitoring the healing of a deep wound). After these stories had been shared, I redirected the group toward their memories of good cases. HA8 responded with a similar story about sending weekly pictures of a patient's infected wound:

> We had one with ah, skin problems, he had a little cut right there (gestures to left elbow area) and his whole arm had that, he had that, what do you call it? Dermatitis, before and then he had little cut and it affected his whole arm and I had to keep taking pictures and then finally, they finally sent him to (the regional center), 'cause his whole arm was all puffed up and all purplish-red. It took him a long time to get better 'cause he was down here (at the regional center) for a while last year. And then we sent him back home and then he had to keep going, keep watching him, and like send pictures every week to see if he's getting better or...but it took a long time for it to get better. He did (travel) twice...we had to send him back down here (to the regional center) again.

While telemedicine did not eliminate the need for travel in this case (as it had in others), the implication is that the patient's progress was monitored in the village clinic thereby allowing him to stay home for longer periods or avoid more trips to the regional center or both.

One last case was brought up before I asked the next question. HA6 remembered:

> That one time we gotta, or a doctor came, came up to have pick up the patient because of the picture...The patient was playing with, you know how some boys use a nail and hit, hit with a (gun) shell and a nail, kapow, and that boy did it and a piece hit somewhere on his neck and when we sent the pictures, it looked deep and bad so the doctor came out... 'cause she was worried about that patient because of the images. But when she came up she said, it looked deeper on the picture than what it actually was.

10.21

Both groups discussed skin-related cases that involved adults and children. Group 1 had plenty of examples of positive experiences; most focused on their good experiences with ear exams and how patients were eager to learn about their ears. Other positive aspects involved their own informal education in the feedback they get from doctors on disorders like cellulitis and their ability to monitor the course of chronic eczema in children.[4]

Compared with Group 1, the health aides in Group 2 did not discuss ear exams except in the context of how perplexed they are at the lack of regional interest in doing follow-ups through the telemedicine system (see Q3). Group 2 gave more examples of skin-related problems and wounds. The cases described by Group 2 were quite serious and reveal how health aides cooperatively assist one another in times of emergency and in the care of patients with long-term problems.

Group 2 presented three cases where patients needed to leave the village, one case where a patient was cared for in the village, and one case where a doctor traveled to the village to accompany a boy with a deep neck wound to the hospital. Two accidents were gun-related and occurred to boys. Health aides in Group 1 only discussed one incident of medivac in their interview, a man with chronic stomach pain. Telemedicine was not viewed as helpful for this man's problems.

Health aides in Group 2 appreciated the use of the digital camera for use in documenting assault cases,[5] while no one in Group mentioned this at any point in the interview. Health aides who were interviewed individually do address this topic.

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[4] Group 2 addresses eczema among children when asked how telemedicine has helped with the kind of health problems of people in their community

[5] Group 2 discusses assault cases in more detail when asked about uses of telemedicine other than the original ear and skin-related problem (QH).

Lastly, one member of Group 2 voiced a positive outcome of telemedicine for health aides. The imaging technology takes pressure off health aides when they must describe the location of rashes or wounds as well as detailing very specific visual characteristics. This advantage is repeated by both groups in Questions 10, 12, 13, and 16): "One picture is worth a thousand words."

Q5: Tell us (a story) about a negative experience that you had with telemedicine in your community/village?

Group 1: The most negative experiences include not being able to get the telemedicine equipment to work (CHA2, CHA4) and not being able to find the information you need immediately. CHA4 believes that at their regional hospital, all they have to do is call maintenance to fix something, but in the village there's no backup: "Up there (in the village) you've got to be everything."

For CHA1, the loss of power in camera batteries was a negative experience. CHA3 was frustrated when everything was done right but then she couldn't send the picture because the communication lines weren't working which lead to a sideline discussion of T-1 lines being installed by GCI (telecommunications company), and their expectations that the T-1 lines will solve this problem. CHA2 remarked that the telemedicine project was "instrumental" in getting better communication lines to their villages; she said,

> (A)s long as people had computers and...they couldn't log on...it was no big deal, but when it came to the point where it was used as a diagnostic tool, then they realized, 'Hey we've got something good here but we can't utilize it.' Then they started getting different equipment out there for communications.

Group 2: One of the quieter health aides in the group (HA11) answered first:

> Sometimes we would send the images and the doctors wouldn't even look at 'em.

To that, HA12 said:

> Once in a while the images won't go through so we have to resend 'em. Some doctors respond right away and some don't (unclear) towards the end of the day. If we don't get a response, then we call.

After this opening, the discussion meandered between HA9 and HA10 about how the new system differs from the old system. Under the old system, health aides sent their images to a specific doctor and now all messages go to RADIODOC. HA8 added:

> On the PEFs, write 'see telemed,' that's all we tell 'em when we fax it in now, 'See telemed.'

HA9 remarked about a negative experience:

> (Our village's) old camera to the old telemedicine unit got stolen, somebody broke into the clinic and took the narcotics and the camera. That was this spring, I think it was. So, they weren't able to take pictures so, I guess you gotta watch those.

HA6 said:

> Our old camera, it was take double, double prints. When IS (Information Services) took it, they say they're gonna fix and send it back, they haven't sent it back yet.

HA10 chimed in:

> For a while our (new?) camera was, it looked like it was centered and then when we'd put the disc into the computer, we'd see only half.

After discussing problems with cameras, HA9 and HA10 started talking about the size of old telemedicine station. HA 10 said:

> It was so big and hard to move!

10.24

Then HA 9 asked:

> So what are they going to do with them now…now that they have the new units up there? Some of these clinics are REAL small.

Then the discussion turned to the AFHCAN system and the live video machine and CH6 and CH10 talked about the infant respiratory cases where they've used the "video thingy." CH7 said:

> They put our video…the television, they put ours there (on the old cart).

Others in the group agreed that their clinics are using the old cart to support the live video camera.

The two groups again responded with different kinds of problems. Group 1 reported more difficulties with the technical aspects of equipment and communication lines while Group 2 focused more on problems with some people – some doctors' response times and theft of a digital camera. Both groups experienced technical difficulties with their digital cameras that indicates the need for trainers to focus more on the care and handling of these items.

Both groups have members who express a lack of confidence in their computer and telemedicine skills. The majority of Group 1, however, repeatedly emphasized their lack of technical support in both the 'Activity Sheets' they completed as individuals, and in a later question concerning disadvantages (Q14). Activity sheet responses are located in Appendix A and a summary of those responses is in the concluding section of this report.

APPLICATIONS

Q10: Let's talk about the health problems of the people in your community and how telemedicine helps with those health problems. For what problems is telemedicine most useful?

Group 1: Telemedicine is most useful for the following kinds of problems: skin (CHA3, CHA1, CHA2, CHA5), ear (CHA2), anything around the face: mouth, nose, eyes (CHA4). Pictures reduce the amount of description that the CHAs have to write regarding the precise location of skin problem as well as the key characteristics of the rash or lesion.

> I write, 'oh it's so big and so raw and so red,' the picture itself could just say all the words so I don't have to write...Like they say, a picture's worth a thousand words (CHA3).

Later on CHA3 returned to this topic:

> I like taking pictures but not having to explain where it is on your, position on your body. Having to take a look and try to write in words that, you could just take a picture and they know where it's at. How it's hard to describe, 'Oh, it's on the right hand on the upper, just below your wrist, almost not in front of the side,' so forth, you know?

Group 2: This group agreed that telemedicine was most useful for skin problems (HA9), cuts (HA9), ear problems (HA12), fractures (HA8).

> Like with arm fractures, it's easy to compare, just put them together like this and (unclear - they'll know?) where the fracture is (HA8).

More specifically, two health aides discussed the use of telemedicine to follow cases of dermatitis on babies and children (HA9, HA10).

> It's pretty hard to describe some things on certain parts of the body...I always have a hard time describing, you know, without, just using my own language, or my own way of talking, but the doctors seem to learn how all of us communicate, it just helps with the pictures...It's hard to describe this (area), is this the inner elbow or is this the inner elbow? And a lot of people with eczema, they have it here too. There are some babies with real bad (unclear – cases?) (HA9)

Health aides from both groups are in general agreement that telemedicine facilitates communication with doctors and is most useful for skin and ear problems but is also used to depict the location and details of injuries.

Q12: One of the things that we're especially interested in is how you've used telemedicine to help people in your community. Tell us about your most memorable cases.

Group 1: Health aides have used telemedicine in several ways to help people in their community. The most commonly mentioned problem, not surprisingly, involved ears (CHA2, CHA1, CHA5).

> If they have an ear problem and then I ask 'em, I ask 'em if I can, if they want to look at their ear on the television or on the telemedicine. And they say, 'Yeah,' and so I turn it on and then let them look at a ear and I say, 'Do you want this to be sent to the hospital? You can look at it and see what they think and they'll talk to me on radio traffic after they look at it, the ear, and see if it's infected or it's not infected, you know?' And then they agree with me. (CHA1)

> The way that I've used it is like, uh, sometimes people think that they have ear infections or they think that they have ear problems. Or they think that something is wrong, and so...like I say, in order to get a second opinion, I get, I get and I'll take a picture. Or I'll...you know (unclear - send?) and then have the doctor, once they get a doctor's opinion, it's kind of like it's okay, you know? And, ah, that's how it's helped the people as far as I could see and the other thing is documentation of, of chronic ear problems and getting tubes in kids earlier...than what they used to, so that there's less hearing loss" (CHA2).

They used telemedicine to solicit a second opinion from the doctors, better document chronic ear problems (and thereby reduce hearing loss), and reassure patients. CHA3 sends pictures of injuries and skin problems because they clearly communicate anatomical positions where written descriptions are not as precise (see her quotes in the previous question's summary).

Group 2: The most memorable cases in the group include examining kids' ears.

HA11: For the kids' ears, when we think they're red and we send the telemedicine, the pictures, we don't need to treat 'em...(unclear – 'cause they say they're not infected).

HA7: When we're not sure about ear infection, we look at the telemedicine and make sure it's (unclear), we use that.

The fiberoptic otoscope increases cooperation with parents as well as fostering more trust in the health aide's decision as the following discussion illustrates:

HA9: It's good for the parents to see the TM (tympanic membrane).

HA7: Some of the kids are curious too.

HA6: When they (the kids) see it, sometimes they don't trust us, but it's better for the parents, the mother to see it, how it looks.

KS: So she's more likely to believe you when she sees?

HA6: Yeah

HA9: As long as the parents don't say, come in and say, 'Can you get the telemedicine and so I can, you know, try to diagnose themselves,' or say, 'See, look, it's red.' Or you know, where they're not going over us, or our skill, our abilities, and you know. I don't know, it just makes me feel better that we're doing the best we can and that these images will also help us, take some of the pressure off of us and, and giving the doctor some of the responsibility once they see that picture. They're helping, you know, to make the right decision. I feel reassured in that way.

HA7: It's reassuring that in the middle of the night, when there's no planes, someone else can see the picture too.

HA9: You don't feel so alone in making these decisions.

HA11: Also it's helpful too when the it's bad weather.

HA7: Like what, what can we do for the patient?

The discussion above reiterates the perspective that telemedicine decreases pressure and responsibility that some health aides feel and also shows how telemedicine provides reassurance to the health aides. Telemedicine is used to reassure patients too.

> If a mom comes in and says, 'My baby has a bad rash,' she looks real tired, and you show her previous rashes that looked worse, it reassures parents that the case isn't so bad, or it was worse before and they got through it (HA10)

Both groups focus on patients with ear problems as their most memorable cases. Here, telemedicine is viewed as having improved relationships between health aides and parents, especially. Because health aides are more reassured, they can be more reassuring. Because health aides have a larger view of the tympanic membrane and access to second opinions, their confidence inspires greater trust among their patients. Heath aides also view long term improvements such as less unnecessary antibiotic use and less hearing loss as valued outcomes.

QH: Besides using the telemedicine system for ear and skin problems, what other kinds of health problems did you use telemedicine for?

Group 1:

> Cuts, we had one person that had a cut on the finger, we took a picture and um, you know his, um, cut the whole finger on, I mean you know. Almost to the bone, or the bone was already (unclear - fractured along with it?) and we took the picture and send it over to the hospital and they said that was a really good picture…They, the, our coordinator was there and she did the sewing, you know stitching and stuff, after they stitch it, they fax it again, or you know take a picture and send it back to the hospital and then next day he had to go in to have x-ray and looked at and...Even broken bones, 'cause I mean if you see somebody with a broken arm or something, you take a picture…(CHA1)

This group soon got off the subject of health problems and shared the many ways that they used the digital camera for enjoyment. Trainers encouraged health aides to take

'snapshots' and other informal images as learning exercises on how to frame and focus and manipulate the images.

> Take pictures of my kids (CHA3)
>
> Put it on our screen saver (CHA4)
>
> Oh, and the itinerant takes pictures of one village to send. (So we) get to see how each clinic'll look, send it back and forth...And so then, maybe send to each health aide so we could see what each buildings look like for each health aide, that'd be so cool (CHA3)
>
> Ah, (our supervisor) wanted to know how the clinic got rearranged when I was in Anchorage, so I took pictures of everything, 'cause I couldn't tell her (CHA2)

Unfortunately, one health aide was "chewed out" by her supervisor for using the camera for non-clinic uses, and she suggested:

> Maybe they could send something to the CHAP department and say, 'Health Aides could use cameras as they please to get better at taking pictures' (CHA3)

Group 2: Health aides in this group reported eye injuries (HA10), assault cases, a tongue laceration, other kinds of lacerations (HA6), fractures (HA8), and dental uses (HA12, HA6). A discussion on assault cases follows:

> HA9: State troopers (for assault cases)...'Cause a long time ago we stopped used polaroids to take pictures if we were the first to see the patient
>
> HA10: And (the photo is) clearer I think
>
> HA9: (The photo) could be used for both, so the doctor can see the extent of the injury but also evidence for...I don't know if they would consider that, I wanted to know if these telemedicine pictures are like official documents in a person's file.
> When I used to work for the CHAP program, there used to be where they would call in (unclear) to go to court, but then that was kind of rare. I don't know what they were subpoenaed for, maybe just to ask about the patient, or I don't know.

HA7: That's how come last time we report our patients for our (unclear - safety), for our records, so if we go court we have doctor's name (unclear)

Health aides reported using telemedicine to obtain advice on how to treat the injuries on children:

> Cuts on the inside of the lip, cut clear through, it was bigger on the inside of the lip (mechanism of injury) was a boat seat that a 5 year old kid banged into; health aides sutured the outside and let the inside heal on it's own (HA10).

> I had a kid who lacerated his tongue. Almost half-way, I had to use the telemedicine for that. He bit on it real hard, somehow, climbing on the beds, and bit on his tongue…
> I had a hard time trying to take a picture, but it worked out. It didn't take long to heal. He's got a very little scar in there. (The doctor said) it would have healed on it's own, just watch him. It went back together (unclear), once in a while he'll stick out his tongue to me and show me what it looks like (lots of giggles) (HA12)

In response to these cases, HA9 described an anticipated application of telemedicine that has not come into use:

> I thought someday we would be able to, ah, the doctor could write on the screen and we could see what they're writing, like how to close something. I thought that would be established by now but it's not, where he could annotate. Say, "Put a stitch here" or "right there." "Do this first." I thought that was something, probably is coming down the line someday.

One health aide (HA12) brought up how her clinic has used telemedicine images with gum infections and, in response to a earlier question, HA6 mentioned using telemedicine for dental purposes:

> Once in a while, dental will want a picture too. So we send it and they have to go over to ER to see the picture and if we're slow they'll call back and say, 'We went over and there was no picture.' (laughs) 'Okay, we called that patient a while ago' (chuckles).

Past the lips, tongue, and teeth, we move into ENT territory, HA10 volunteered:

> We took a picture of somebody's throat one time with the ear otoscope.

Lastly, HA9 mentioned that she has used the digital camera to "monitor birth marks when they're changing."

The similarities of groups' use of telemedicine beyond ear exams and dermatology extends to injuries like cuts, lacerations, and fractures. Group 2 discussed using digital photography for assault cases and the otoscope for dental use. Although neither of these uses were mentioned by Group 1 in any part of their interview, other health aides who were interviewed have used the digital camera to document injuries from assault and dental-related problems.

Q13: What are the advantages of having a telemedicine station in your community?

Group 1: Perceived advantages of having a telemedicine system in one's community are saving money by sending picture to ENT specialist rather than traveling to Anchorage (CHA3, CHA1, CHA2, CHA4); the ability to document chronic ear problems (CHA3, CHA 5); and patient education (CHA5).

Group2: Perceived advantages are a decrease in the need to draw or depict problems (HA6). With respect to ear infections, many health aides say that there has been a decrease in antibiotic use (HA10); patients don't have to travel out as often (HA10); "you feel closer to the hospital even though you're not" (HA9); and it's educational for doctors, us, and the patient (HA12).

No lengthy quotes are included in this section because the answers are concise and brief, and earlier quotes and cases illustrate the health aides' points. Both groups recognize the advantage of preventing unnecessary travel and the educational value of telemedicine. Group 1 emphasizes saving money and the ability to document chronic ear problems while Group 2 focuses on the descriptive value, decrease in antibiotic use, and feeling reassured by closer communication.

Q14: What are the disadvantages of having a telemedicine station in your community?

Group 1: Perceived disadvantages of having a telemedicine system in one's community are spending too much time on the computer. This includes trying to find

"lost" files, looking incompetent in front of patients, other patients waiting longer (CHA5 and CHA4). One older health aide (CHA4) described a scene this way:

> (The patients) kind of look at you, like 'You're gonna us that on me?' (laughs) 'You can even turn it on!' (laughs)

Another disadvantage is the amount of space the telemedicine station takes up in the small clinics (especially bothersome when the equipment isn't working - CHA3). A third disadvantage is that on occasion the equipment doesn't work as it should because of a lack of maintenance (technical support - CHA 2, 3, 4, and 5). CHA3 and CHA5 reported difficulty getting the equipment repaired; e.g., bureaucratic runaround and ordering parts as the following discussion illustrates:

> CHA3: And the equipment not working, no follow through for, follow maintenance at least...Like if there's, if our equipment's broken down, nobody comes out
>
> CHA4: No maintenance
>
> CHA3: So it's broken, who's gonna fix it? Who's gonna pay for it?
>
> CHA5: And we try to contact the person and they keep telling you call somebody else, call somebody else.
>
> CHA3: Transferred back and forth, and it just sits there.
>
> CHA5: And then if you order, something else comes in and it's not for that computer, it gets frustrating, yeah

A fourth disadvantage involves the doctors not responding (CHA2 and CHA3). The CHAs also offered solutions for some of these problems: a telemedicine technician and more centralized communication center for doctors in the regional centers.

Group 2: Perceived disadvantages are general technical problems (HA9) and limited space in clinics (HA10). Under general technical problems, specific examples are that telemedicine requires electricity (HA7), monitoring the quality control of focus, and care for expensive bulbs that burn out. The following discussion illustrates some of the health aides' perspectives:

> ...The focusing part where you have to try to focus it right. You have to put it on a, like on a white paper (unclear) before you could take a picture (HA12)
>
> Couple of time, we have a burnt-out bulb on that first one and we have to order it (HA7)
>
> 'Cause they didn't tell us to turn it off (unclear - when we're) done using it. We just...Here it is, it's on and they didn't say, 'turn if off or the light bulb's gonna burn out,' because that happened to us. Our light bulb burned out and we didn't have an extra one so we had to wait few days for a new one to be sent out. That's when they said, 'You gotta start turning it off.' (laughs) (HA10)
>
> And it takes a while to warm up when you're gonna use it (HA7)

Another technical difficulty is the otoscope lens fogging up in some situations:

> HA6: When, um, a kid has a draining ear and with the otoscope once we put it in, get it positioned right away and take a picture right away. 'Cause if we just leave it in there and try to move it around and try to get a good shot, then everything get all fuzzy...it get like out of focus.
>
> HA10: (unclear - to see) from the moisture in the ear and then you put that in and it fogs up the tip of that (unclear)
>
> HA6: The lens
>
> HA10: The lens, yeah
>
> HA6: Otherwise you have to know right away, or do it the first time and know which way the position is, wipe it off and then take it again...and with a fussy little kid, it's not fun.

One health aide (HA6) commented that telemedicine was "miss-able" when the region was "disconnected" while transitioning from the NLM system to the AFHCAN system. I asked for her and others to elaborate on that. Two health aides (HA6, HA9) stated that they aren't "technology kind of people" and that they didn't miss it that much. Another health aide (HA8) remarked that "some (doctors) don't even know how to operate it either, I guess."

Both groups shared general views on the disadvantages: increased time spent working with computer (quality control, repair, sending images), the stations take up a lot of space in the smaller clinics, lack of technical support, and some doctors don't respond to their transmission.

Q16: When you send a picture to a doctor in your regional hospital, what is the single most important thing he or see can do to make that consult a helpful or useful one?

Group 1: The single most important thing a doctor in the regional hospital can do to make the consult helpful is to look at the pictures that health aides send and respond (CHA2, CHA3, CHA4, CHA1) especially for follow-up cases.

> Like if we send a picture to the doctor and then they look at it, and they tell us to follow 'em up a couple days after, we can take, if we take another picture, he can look at it again and compare them together, maybe two, that will the health aides (CHA1).

CHA3 said that without feedback, the health aides don't know what the doctor is thinking, but with the ear training they received and timely responses, they are more confident and understand why doctors change medications in cases where the original treatment doesn't work. CHA1 and CHA4 agreed with her. CHA2 states:

> (Some) doctors have NOT been oriented to telemedicine. And there's always a big turnaround so a lot of 'em don't (use it).

Group 2: Unlike Group 1, there was no single thing upon which this group agreed. Four members were vocal with the others nodding in agreement. First, HA6 said the most important thing was…

> …[T]he doctor's eyes and knowledge…to know that he had seen, like there's whole different kinds of rashes, any kind of rash we try to describe, we can describe this, this, this, or this rash. And um, when they just look at it they know, they have a better idea of what it is or what's the problem.

Like the majority of Group 1, HA implies that the doctor must look at the image and use his or her skills to make a diagnosis that is beyond the scope of the health aide's abilities. HA9 then added that the doctor's…

> Sharing the responsibility of it not being only me that, you know, that I, it was my eyes that saw this (unclear) you know this type of (unclear), did I make the right, did I describe it like how I was supp...as good as I should?

Then she cautioned:

> As long as we don't lose that description skill, (and) we (become) totally depend on telemedicine…'cause funding may run out.

A comment made by HA12, referred to the necessity of the doctor responding to the image. To her, the response, or feedback is the most important thing, and this echoes what the majority of Group 1 stated. Finally, HA10 brought up an example where she received different messages from doctors at the regional center:

> That eye (a case she mentioned earlier), one doctor didn't think it was too bad, but the other one, I don't know if he was a doctor or not. There was the doctor that I was used to and then I guess she was training another doctor or something, letting him get used to the routine, and our doctor thought it was more serious than that other one. Either way the patient still stayed at home.

This could be interpreted as confusion on the health aide's part as to which doctor's advice to follow, however the following conversation between HA9 and HA10 suggests the shifting of more responsibility toward the doctors results in health aides losing their power to make decisions about what is best for the patient.

> HA9: And before it was like, it depended on how serious WE thought it was, if we were comfortable handling something like that.
>
> HA10: Now it's completely up to the doctors whether we can (unclear – send patients) or not. Because I had a patient with bug bites that got really red and swollen, and I thought he should come down (to the regional hospital), and we did couple follow-ups and they still didn't (unclear – let him come)…it got better BUT it got WORSE before it got better (laughs)
>
> HA9: It also depends on how trained some health aides are, some older ones can say, "Oh yeah, I could handle that, it'll be hard but I'll handle it," and where a younger ones they may be uncomfortable keeping a person like that in the village.

So HA9 summarized her ambivalent feelings this way:

> [When] we had C.B. radio and ham radios, (lots of voices overlapping)…that's where the, it's total responsibility was on how well they're trained and how comfortable they are. And now it seems like that's kind of taken away which is good in a way, you don't have to worry about your patient but if they (the doctors) make the wrong decision, it could be bad too.
>
> They train us up to a certain level and expect us to practice at a certain ability and then give us a tool that might...might make us more dependent on something, our technology or computer or, stuff like that, I don't know, I just have mixed feeling about it.

After I presented my summary of their responses, HA9 tried once more to clarify her point:

> Someday parents might just come to the machine (and miss) keeping the importance of the health aide's experienced opinion.

HA6 clarified her view too. To her, the most important thing that makes a telemedicine consult useful or help is:

The decision made by the doctors whether the patients should stay in the village or go to the hospital.

Although expressed in different ways, Both groups depend on a doctor's response to the images they send for the consult to be of any use. Most doctors respond but it can be frustrating for health aides who don't get the feedback they are requesting.

Most health aides appear relieved that doctors are now available to make more difficult decisions for them. One member of Group 2, however expresses her ambivalence about having less responsibility and losing a primary role in making decisions about patients' care. Health aides are now in the position of learning to trust the doctors' decisions rather than using their own judgement. Sensitivity to this ambivalence on the doctor's part at this time of transition could alleviate the trepidation that some health aides feel.

CONCLUSIONS

The introductory question established that most the health aides associate telemedicine with computers, ears, and taking pictures for doctors. Some also associate communication, skin problems, reducing the need to make detailed descriptions, and taking the pressure off health aides with telemedicine. These themes are repeated throughout the focus group conversations.

The first question on training revealed sharp distinctions between the two groups in their recollections of training. The eldest member of Group 1 was quite critical and the others followed her lead – sometimes confusing the NLM system with other computer systems introduced by the regional health corporation. Basically, Group 1 was frustrated by a lack of technical support and collectively, they wanted more training on all aspects of telemedicine OR to create a telemedicine technician position. Although the latter is an unlikely option, it expresses their lack of confidence in the skills necessary to work with telemedicine equipment. Both groups of health aides expressed frustration with the common problem of "losing pictures."

The next question on how health aides have helped each other learn was most rewarding and filled with insightful stories on the fears and encouragement they give one another. The question on how to improve future training led to the two groups stating different preferences: increased quantity of training time with patients OR increased quality of training time without patients. Both groups explicitly stated that they do not want full responsibility for training co-workers on telemedicine, especially for younger health aides this can lead to awkward situations with her elders. Health aides closed by discussing new approaches to training that warrant careful consideration.

The section on experiences highlighted several cases that reveal both pleasant and unpleasant surprises as well as positive and negative experiences. The most positive experiences involved helping patients with serious ear problems, skin-related problems, and wounds while the most negative experiences were failures of equipment or failures of communication.

The section on applications has shown that health aides from both groups believe that telemedicine, despite the problems, facilitates communication with doctors. Ear problems are the most memorable cases in both groups. In addition to better communication with doctors, health aides reported that patients have come to trust them more on ear-related matters and they are better able to offer reassurance in other cases. Beyond the use of telemedicine for ears and skin, health aides value its use for all kinds of injuries (often on the face and mouth area), cuts, lacerations, fractures, dental problems, and for the medical and legal aspects of assaults.

The questions in the critiques section probed for advantages and disadvantages. Health aides in these groups recognized that telemedicine prevented unnecessary travel and antibiotic use. Following this, they recognized the potential to save money and prevent resistance to antibiotics, respectively. They recognized the educational value for themselves, their patients, and the doctors. They recognized the ability to document chronic ear problems and chronic skin conditions. They recognized that images offer a better description that they can provide with words. And finally, they recognized that they and the patients feel reassured that the best available care has been offered.

Disadvantages are fewer but strongly felt. Some health aides perceive that more of their time is occupied with computer and technology-related tasks and that the

telemedicine stations take up too much room in the smaller clinics. A lack of technical support is felt more or less by both groups. And finally, some doctors haven't been as responsive as the health aides would like them to be which leads to the final question. A doctor's feedback is of critical importance to the health aides: that's the reason for having a telemedicine station in their village. Despite the ambivalence a few health aides may feel about the lessening of their value, all the health aides appreciate not having to make difficult decisions alone.

The remainder of this report is a summary of the responses made by 16 health aides (12 in focus groups and 4 in individual interviews) regarding an 'Activity Sheet' (see Figure 1). I view these responses as concise "sound bytes" that highlight much of what has been reviewed here.

Figure 1

WHAT HAVE YOU HEARD ABOUT TELEMEDICINE IN YOUR COMMUNITY?

A majority of the responses to this question were positive (n = 11). Examples of comments are:

> 'Hey, I hear you have some good new equipment.' (CHA2)
>
> 'So high tech but it's cool!' (CHA3)
>
> 'How interesting!' (CHA4)
>
> People in my community like it. (CHA5)
>
> 'It's good to know the doctors can see us.' (HA6)
>
> Being effective in a way where the patient or guardians were able to actually see the problem more (confident) and efficient. (HA13)
>
> Many people were happy to have this new technology in our clinic. (HA14)
>
> Very useful in time of gross emergency to send out, medivac flights. (HA16)

References to the pictures or images (n = 10) were also common as the following statement illustrate:

> 'I didn't know my ear looks like that!' (CHA1)
>
> 'Is that what our ears look like in there?' (HA11)
>
> 'Gee!! Doctor can see what is going on faster than before. You mean Doctor's can see it now, the picture you send?' (HA8)
>
> I have not heard much outside the clinic, but when we say 'let's take a picture for the doctor,' they seem reassured that we are doing the best we can. Especially when we as CHPs are unsure of what we are seeing and we have the technology to sent images to the doctor. (HA9)

Half of the comments express surprise, excitement, or curiosity (n = 8). A similar number of statements make reference to the ear (n = 7). Often these two themes overlapped.

> People come in with excitement with looking at their ears and what all the other things you can do. (CHA4)

> It was started off helping us in diagnosing ear problems so people in my community think it's "cool" to look in their own ears and see what their ear drums look like. (CHA5)

> When the telemedicine first came out people were amazed that we were now able to take pictures of the ear and pictures from the digital camera. (CHA 14)

The quote below as well as a few of the comments above illustrate how some health aides remark that they hear community members refer to the state of technology (n = 6) as well as allude to educational value (n = 5):

> Wow, technology has reached the villages, so that's what an ear looks like inside. (HA10)

WHAT DO YOU THINK ABOUT TELEMEDICINE IN YOUR COMMUNITY?

A majority of the responses to this question were also positive (n = 9) in that they remarked on the helpfulness or usefulness of the NLM system.

> Can be useful but sometimes or most (times) NO time to sit to do a 2nd (form). (CHA3)

> It is helpful for our problems (HA6).

> I didn't think it would benefit us, that it might just be waste of time. I was wrong, took time to learn (HA12).

> Makes CHP work easier and creating complete descriptions. The telemedicine would be very beneficial for the whole community (HA13).

Half of the responses referred to doctors (n = 8).

> I think it is okay if you get feedback from the Doctors that look at the picture you send (CHA1).

> I think it helps the patient and the doctor (see) how the ear really looks (HA7).

> Oh boy!! The Doctor can see the picture and have a better idea of what is going on (HA8).

> It helps when something is hard to describe to the doctor (HA10).

> I think it's a good tool to use to help us with diagnosing when we need help with the doctors (CHA5).

Some responses refer to images sent (n = 5) and some to the health aide's role (n = 5); the quote below illustrates both.

> Takes some of the full responsibility and pressure off of us as health care providers. Once the doctor sees the picture he/she is now partially responsible for helping to make the best decision (HA9).

WHAT DO YOU SAY ABOUT TELEMEDICINE IN YOUR COMMUNITY?

A majority of the responses to this question involved comments about sending pictures and images (n = 12).

> 'Hey guys, we have a chance to let the doctor take a look.' (CHA2)
>
> We tell the patient, 'The doctor will see the image of the ear - will describe more. Don't cry and we'll do it real quick. Be still.' (HA7)
>
> '...So the doctor can actually see your problem/ear/skin too.' (HA9)
>
> Explain to the patients and guardians that telemedicine is a form of better and live viewing of an ear or other body parts and show (demonstrate) them. (HA13)

As you can see from several of the previous quotes, most of the responses also include a reference to doctors (n = 11). Some responses mention that telemedicine helps with diagnosis or is a diagostic tool (n = 5) and an equal number of responses refer to the patient (n = 5). Some responses involve a reference to ears (n = 4).

> 'This can help by sending it to a Dr. so they can help with a diagnosis.' (CHA3)
>
> 'Through these (things) the doctor can see/hear your problem. It helps them know what we can do for you.' (HA6)
>
> (referring to Pt) 'This will help the Doc if you need treatment and he agrees with what I see, then he will give you the right medication.' (HA12)
>
> I tell patients this will only help them. The doctor will be able to see what their problem is and better their treatment. (HA14)

WHAT DO YOU FEEL ABOUT TELEMEDICINE IN YOUR COMMUNITY?

The vast majority of the responses to this question were positive (n = 14).

> I think it would be more useful if they have enough time to train use of it (telemedicine). Also I like it because we show patients about the inside of the ear. (CHA1)

> It can be very helpful, can be very useful with the right equipment working right. (CHA3)

> It is a helpful tool to determine if patients need to go to hospital, or can be taken care of in the village (HA6).

> I feel good as long as patients don't start to think less of my judgemental skills which they totally relied on before and which I worked so hard to establish in the first place. It took a long time. (HA9)

> I feel proud or more helpful to the people. (HA11)

> I feel that this is a very positive step towards patient care that we give in our communities. I am very excited that the doctors are able to also better assess patients or confirm their/our assessments of our patients. (HA14)

> (I) feel great about it! Helps me to better communicate with the Doctors (HA15)

> I'm scared to use it. I am so illiterate on computer. I feel it should continue since it has been very useful. (HA16)

Less common, but referred to sometimes, are doctors (n = 6) and patients (n = 4).

> I feel it would do good for communicating with the Doctors on various problems in helping us with our diagnoses and treatments. (CHA4)

> I feel it is useful and helpful to use, the doctors, and also the patient if we need help. (CHA5)

> Oh what a relief to know that the Dr. can see what I am describing. (HA8)

Appendix A

Q6: WHAT DO YOU HEAR ABOUT TELEMEDICINE FROM PEOPLE IN YOUR COMMUNITY?

CHA1: People that come in to see ear problem say, I didn't know my ear looks like that.
(ear, surprise, education, images*)

CHA2: Hey, I hear you have some good new equipment.
(technology, positive)

CHA3: So high tech but it's cool. WOW.
(technology, surprise, positive)

CHA4: What is that? How interesting! People come in with excitement with looking at their ears and what all the other things you can do.
(curiosity, ears, education*, positive, surprise, other, images*)

CHA5: People in my community like it. It was started off helping us in diagnosing ear problems so people in my community think its "cool" to look in their own ears and see what their ear drums look like
(positive, ear, education,* images*)

HA6: It's good to know the doctors can see us.
(positive, doctors, images*)

HA7: We have good comments from the parents how it works.
(positive, parents)

HA8: Woo!! Man!! Gee!! Doctor can see what is going on faster than before. You mean Dr's can see it now, the pic you send?
(doctor, efficient, surprise, images)

HA9: People are usually saying good things about the telemed. I have not heard much outside the clinic, but when we say "let's take a picture for the doctor," they seem reassured that we are doing the best we can. Especially when we as CHPs are unsure of what we are seeing and we have the technology to sent images to the doctor.
(positive, doctor, reassure, technology, image, health aide)

HA10: Wow, technology has reached the villages, so that's what an ear looks like inside.
(surprise, technology, ear, education, images*)

HA11: Is that what our ears look like in there?
(surprise, ears, curiosity, images*)

HA12: Wow! Cool!
(surprise, positive)

HA13: Being effective in a way where the patient or guardians were able to actually see the problem more (confident) and efficient.
(positive, parents, education*, confidence, efficient, ears*, images*)

HA14: When the telemedicine first came out people were amazed that we were now able to take pictures of the ear and pictures from the digital camera. Many people were happy to have this new technology in our clinic.
(ears, camera, positive, technology, surprise, images)

HA15: That it was an x-ray machine.
(technology)

HA16: Very useful in time of gross emergency to send out, medivac flights - per health aide use.
(positive, emergency, medivac, health aide)

Q7: WHAT DO YOU THINK ABOUT USING TELEMEDICINE IN YOUR COMMUNITY?

CHA1: I think it is okay if you get feed(back?) by from the Doctor's that looks at the picture you send
(feedback, doctor, image sent)

CHA2: Great diagnostic tool. Good source for an expert or second opinion.
(praise, diagnostic tool, second opinion)

CHA3: Can be useful but sometimes or most NO time to sit to do a second PASI. Also need to upgrade T1 in order to use the hi-tech equipment.
(useful, no time for extra form, need better communication lines)

CHA4: I think it would be very helpful.
(helpful)

CHA5: I think it's a good tool to use to help us with diagnosing when we need help with the doctors.
(diagnostic tool, helpful,* doctor, feedback)

HA6: It is helpful for our problems.
(helpful)

HA7: I think it help the patient and the doctor how the ear really looks.
(helpful, patient, doctor, ear, image sent)

HA8: Oh boy!! the Dr. can see the pic and have a better idea of what is going on.
(excitement, doctor, image sent)

HA9: Takes some of the full responsibility and pressure off of us as health care providers. Once the doctor sees the picture he/she is now partially responsible for helping to make the best decision.
(reduces responsibility, reduces pressure, health aides, doctor, image sent, 2nd opinion)

HA10: It helps when something is hard to describe to the doctor.
(helpful, description, doctor)

HA11: I think it is very useful to us and the patient and the doc.
(useful, health aides, patients, doctors)

HA12: I didn't think that it would benefit us, that it might just be waste of time. I was wrong, took time to learn.
(doubtful at first, helpful, time to learn)

HA13: very Make CHP work easier and creating complete descriptions. The telemedicine would be beneficial for the whole community.
(helpful, description, health aides, community)

HA14: I think this advancement in our patient care has made our assessments better and it improves the quality of care we as health care providers give to our patients.
(better diagnosis, patients, improves care, health aides)

HA15: It is great! Dr's actually see what we try to describe.
(praise, doctors, images sent, description, health aide*)

HA16: (no comment)

Q8: **WHAT DO YOU SAY (about telemedicine in your community)?**

CHA1: When I show patient about the ears or skin, I tell them that is how your ears looks and I'm sending it over to Doctors to look at.
(patient, ear, skin, send image, doctor)

CHA2: Hey guys, we have a chance to let the doctor take a look.
(send image, doctor)

CHA3: This can help by sending it to a Dr so they can help with a dx (diagnosis).
(send image, doctor, help with diagnosis)

CHA4: I hope to know everything about the computer, cameras, and everything connected to telemedicine.
(want to learn, computer, cameras)

CHA5: I say it's a good tool to use if you want help in diagnosing and the doctors get to see what is going on with the person or persons.
(diagnostic tool, send image, doctors)

HA6: Through these (things) the doctor can see/hear your problem. It helps them know what we can do for you.
(send image, doctor, helps diagnose)

HA7: We tell the patient, the doctor will see the image of the ear - will describe more. Don't cry and we'll do it real quick, be still.
(patient, doctor, send image, ear, don't cry, it's fast, be still)

HA8: Now the Dr. can see what I am try to, I am trying to write or say on the P.E.F.
(doctor, send image, description)

HA9: ...so the doctor can actually see your problem/ear/skin too...
(doctors, send image, ear, skin)

HA10: Taking these pictures will help me and the doctor help you with your health problem.
(send image, health aide, doctor, help diagnose)

HA11: I say, 'man, what can we do without it?' **(not sure - important tool?)**

HA12: (referring to Pt) This will help the Doc if you need treatment and he agrees with what I see then he will give you the right medication.
(patient, doctor, help diagnose, send image, right treatment)

HA13: Explain to the patients and guardians that telemedicine is a form of better and live viewing of an ear or other body parts and show (demonstrate) them
(patients, parents, send image, ear, educate)

HA14: I tell patients this will only help them. The doctor will be able to see what their problem is and better their treatment.
(patients, helpful, doctor, send image, right treatment)

HA15: I want the computer up and running now! **(not sure - important tool?)**

HA16: (no comment)

Q9: **WHAT DO YOU FEEL ABOUT USING TELEMEDICINE IN YOUR COMMUNITY?**

CHA1: I think it would be more useful if it they have enough time to train use of it (telemedicine). Also I like it because we show patients about the inside of ear. **(needs improvement: training, positive, patient education)**

CHA2: Good idea. Problem - can we use one piece of paper for communication instead of two. We need one telemed technician. **(positive, needs improvement: paperwork, needs improvement: tech support)**

CHA3: It can be very helpful, can be very useful with the right equipment working right. **(helpful/useful, needs improvement: tech support)**

CHA4: I feel it would do good for communicating with the Dr's on various problems in helping us with our diagnosis and treatments. **(positive, communication with doctors, help diagnose and treat)**

CHA5: I feel it is useful and helpful to us, the doctors and also the patient if we need help. **(useful/helpful, health aides, doctors, patients)**

HA6: It is a helpful tool to determine if patients need to go hospital, or can be taken care of in the village. **(helpful, patient travel)**

HA7: When you don' t have much training, it's very diffult to use telemedicine, mostly when you are old, your mind is slow. **(need more training, difficult to learn, old, slow)**

HA8: Oh what a relief to know that the Dr. can see what I am describing. **(relief, doctor can see image, description)**

HA9: I feel good as long as patients don't start to think less of my judgement skills which they totally relied on before and which I worked so hard to establish in the first place. It took a long time. **(positive, patients value health aide)**

HA10: I like using it after I get comfortable with the equipment. **(positive, comfortable, equipment)**

HA11: I feel proud or more helpful to the people. **(positive, self-esteem)**

HA12: It is very helpful especially for the Pt's. We can always do F/U's (follow ups) to see if there is an improvement or not. It's educational. **(helpful, patients, follow-ups, educational)**

HA13: Satisfactory outcome and advanced/improved technology in a village. Give us a better description and closer work with MDs. **(positive, technology, description, feel closer to doctors)**

HA14: I feel that this is a very postive step towards patient care that we give in our communities. I am very excited that the doctors are able to also better assess patients or confirm their/our assessments of our patients. **(positive, patient care, doctors can better diagnose)**

HA15: Feel great about it! Helps me to better communicate with the Doctors. **(praise, communicate better with doctors)**

HA16: I'm scared to use it. I am so illiterate on computer. I feel it should continue since it has been very useful. **(scared, illiterate on computer, useful)**

Telemedicine and Antibiotics in Rural Alaska

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Abstract

Objective. This study assesses the association between use of ENT-related telemedicine equipment and antibiotic dispensing by community health aides (CHAs).

Method. An evaluation of ENT-related telemedicine equipment in 26 rural Alaskan communities was established. Data were collected from patients presenting with ear problems and CHAs between February, 1998 and September, 1999 using a staggered interrupted time-series design. A total of 2,555 matched patient-CHA self-report questionnaires were collected during this time. Chi-square tests were used to compare pre- and post-implementation rates of antibiotic dispensing, and to assess the association between antibiotic dispensing and both a) use of the digital pneumatic otoscope and b) remote consultation based on the digital image sent to a consulting provider. Logistic regression analysis was used to examine these associations while controlling for covariates.

Results: Antibiotics were dispensed for marginally fewer patient encounters post-implementation (64%) compared to pre-implementation (69%). Although both use of the otoscope and remote consultation were bivariately associated with reduced antibiotic dispensing, only use of the otoscope (OR = 9.01, 95% CI = 3.46,23.46) remained a significant predictor of antibiotic dispensing in the logistic regression model.

Conclusions: The findings of this study suggest that the introduction of digital pneumatic otoscopes may enable more judicious dispensing of antibiotics by CHAs.

Keywords: otitis media, acute otitis media, antibiotics, telemedicine, rural health care

Widespread use of antibiotics has contributed to a crisis in antibiotic resistance (1). The treatment of otitis media (OM) is the most common reason for administering antibiotics to children in the US (2). One study found that of 2553 infants followed for 2 years, 91% had been diagnosed with at least one episode of middle ear effusion (3). Over the past two decades there has been an increasing trend in the incidence of otitis media (OM) among children (4,5). This, and the overuse of broad-spectrum oral second and third generation cephalosporins in the treatment of children, have been identified as key factors in the development of antimicrobial resistance (5).

Reasons for overprescription of antibiotics for pediatric OM cases include parental pressure (6) and unclear diagnostic criteria (2). In one survey, pediatricians cited pressure from parents as the number one factor contributing to inappropriate use of oral antibiotics (6). Furthermore, diagnosis of acute otitis media (AOM) is not straightforward (7). The diagnosis of AOM, which is typically treated with antibiotics, may be difficult to distinguish from otitis media with effusion, for which antibiotics are not indicated (4,8,9). To avoid missing the more serious diagnosis, physicians may err on the side of caution and prescribe antibiotics.

There is some evidence to suggest that antibiotic overprescription may be greater in rural compared to more urban areas. Higher rates of OM have been identified in children residing in rural compared to urban regions (10). Even if rates of ear disease are equal, rural health care providers may feel more pressure from parents to treat with antibiotics (6), perhaps due to logistical problems associated with follow-up exams. Any treatment strategy, such as immediate treatment with antibiotics, which may require

fewer follow-up visits (11) may be particularly appealing to rural patients for whom access to health care is often limited by distance.

Rural Alaska is one such rural setting that poses several challenges to the provision of health care. Within Alaska are over 200 remote villages, with residents numbering from 25 to over 1,000. A system of community health aides (CHAs) has developed to provide health care to this highly dispersed population. The CHA is a local person chosen from each community to be its primary health care provider. Over the course of two years, CHAs receive 15 weeks of intensive medical training at a hospital-based center and become certified after several hundred hours of field experience and various written and practical examinations (12). The CHAs are supervised by physicians, registered nurses, physician assistants, nurse practitioners, and other CHAs largely by phone; physician visits to the villages are infrequent (12).

Mirroring the experiences of other health care providers, CHAs are often faced with assessment of potential ear problems (13). As in other rural areas, the logistics of travel to and from the regional hospital may exert pressure on the CHAs to immediately treat any suspected AOM case with antibiotics. Parental pressure to prescribe antibiotics may be felt more by CHAs compared to practitioners in other settings as the CHAs typically have very close kinship and friendship ties in the communities they serve (12). Furthermore, CHAs may experience more real or perceived challenges to their diagnostic decisions and treatment management plans due to the minimal training they receive relative to other health care providers. This may result in their being overcautious and ultimately overprescribing antibiotics.

Several methods of limiting the overprescription of antibiotics have been suggested. Given the pressure exerted by parents to prescribe antibiotics, there is a great need for tools that will help health care providers communicate more effectively with patients (and their parents) regarding the potential harm of unnecessary antibiotic use (6,14). The provision of a set of practical diagnostic guidelines (14), along with methods that increase visualization of the tympanic membrane (TM) (7), are key to accurate diagnosis of AOM. New technologies should also be considered as vehicles for increasing both patient-provider communication and diagnostic accuracy (14,15).

The field of telemedicine may be one place to find new technologies that incorporate the above-mentioned methods of reducing inappropriate use of antibiotics. Specifically, the provision of a digital otoscope and means of transmitting images to a consulting provider may be expected to reduce antibiotic overdispensing by CHAs for several reasons. First, the use of the digital otoscope alone might allow for better diagnosis as it provides a larger, wider-angle view of the TM compared to the standard equipment. The digital image captured by the equipment may further increase diagnostic accuracy as it allows CHAs more than a fleeting glimpse of the TM. The digital image may also be used as a tool to educate parents about the ear problem, thus potentially relieving some of the pressure felt by the CHA to prescribe antibiotics. For example, a parent presented with a large picture of their child's perfectly normal TM may be more easily convinced that there is no need for treatment with antibiotics. Finally, images that are ultimately sent to the consulting provider may provide the basis for more accurate diagnosis, thus less use of antibiotics. This consultation, as well as repeated use of the digital otoscope without the benefit of consultation, may have the

additional benefit of serving as a means of ongoing training for the CHA, ultimately increasing diagnostic accuracy.

The purpose of this study was to assess the association between use of ENT-related telemedicine equipment and the dispensing of antibiotics by CHAs in rural Alaska. Specifically, the following research questions were addressed:

1. Is the introduction of ENT-related telemedicine equipment into the village clinics associated with a change in the frequency with which antibiotics are dispensed by CHAs?
2. After implementation of ENT-related telemedicine equipment, is there an association between use of the equipment and antibiotic dispensing by CHAs?
    a. Is there an association between antibiotic dispensing and the use of a digital pneumatic otoscope?
    b. Is there an association between antibiotic dispensing and the use of remote consultations using digital images?
3. Does any association between antibiotic dispensing and use of telemedicine equipment remain after controlling for certain patient and encounter characteristics (e.g., age, severity of the case)?

Methods

Setting

From 1997-1999, Alaska Native Health Corporations in the four main regions in Western Alaska: Maniilaq, Norton Sound, Bristol Bay, and Yukon-Kuskokwim, participated in the Alaska Telemedicine Testbed Project (ATTP). Patients and CHAs

from 26 rural communities within these regions, as well as consulting physicians and other health care providers from each region's hospital, participated in the project.

Intervention

The ATTP focused on the evaluation of telemedicine for ear-related patient encounters. A patient encounter was considered ear-related if at any time during the encounter the patient's ear was examined. This included examinations due to everything from a child complaining of ear pain to an adult with an earlobe laceration. The project sought to evaluate several aspects of providing ear-related primary care with the assistance of telemedicine equipment, including patient, CHA, and physician satisfaction with telemedicine, costs of doing telemedicine, and effects on health care provider turnover (16).

The intervention consisted of the following steps:

(1) The CHA used a digital photographic pneumatic otoscope (American Medical Development, Andover, MA) instead of the standard pneumatic otoscope in the course of an exam.

(2) If the CHA required consultation before developing a patient care plan (e.g., is inexperienced, has little training, or otherwise cannot rely on standing medical orders), she sent the image captured by the otoscope to a consulting provider at that region's hospital via email.

(3) Upon receiving the image, the consulting provider assessed the images in conjunction with written and oral reports of history and findings from the CHA, and reached the CHA by telephone to convey his or her diagnosis and patient care plan.

In addition to the digital photographic pneumatic otoscope, each village clinic was provided with a personal computer containing software developed for ATTP and a modem. The software was based on the Microsoft Active X desktop with an ATTP-developed medical query form and image capture capability.

Community health aides and providers were trained in the use of the telemedicine equipment. These on-site trainings, conducted both at the village clinics and at the regional hospitals, were provided by a variety of experienced practitioners including physicians, advanced nurse practitioners, and physician assistants, using a University-approved curriculum based on existing community health aide program training protocols. Videos on ear disease assessment and diagnosis, and hands-on training were provided. The CHAs were offered 2 college credits for completing the training.

Design and Data Collection

The design of the evaluation was a staggered interrupted time-series design in which baseline data were collected from each site before the intervention was implemented. The implementation occurred at different times for the four regions. This resulted in differing ratios of baseline/post-implementation data among the regions. This design was used to partially control for the large seasonal effects that occur in Alaska, as well as other secular trends.

Survey data were collected from the CHAs and patients at each of the participating village clinics, and from the consulting providers at the regional hospitals. Patients and CHAs each filled out a survey for every ear-related encounter; the consulting providers only completed a survey when they were consulted. For the

purposes of the present analysis, only patient and CHA data were used. Baseline satisfaction data were collected before implementation of the telemedicine equipment and consisted of a survey that assessed demographic information, attitudes about care, and preferences for travel to the regional hospital. Baseline data from the health care providers included questions about abilities to meet patient needs, antibiotic use, and referral to the regional hospital. Post-implementation satisfaction data included questions about experiences with the telemedicine technology in addition to all the questions contained in the baseline questionnaire. At each of the regional hospitals, training in survey administration was provided for project liaisons representing each of the village clinics for that region.

For all ear-related encounters, surveys were completed by the CHAs and patients[1] at the end of the clinic visit. Informed consent was obtained from each patient prior to completion of the survey using a form approved by the University of Alaska Anchorage Institutional Review Board. To estimate survey response rates, data on number of patient visits for ear-related problems were collected from the Daily Medical Logs (DML) maintained at each village clinic. Over the study period there were occasions when certain villages were unable to send all of the DML entries for a given month. For this reason, the response rate estimates presented below are likely to overestimate the actual response rate to some degree, and should therefore be interpreted with caution. Once the DML forms were received from the clinics, an experienced physician assistant determined whether each visit noted in the DML for the period of the study was ear-related or not.

Measures

The outcome variable came from the CHA survey. The CHA was asked, "Did you give antibiotics?", and responded with a "yes" or "no" answer. For the present analysis, "use of telemedicine equipment" was defined as using the digital otoscope during an exam, and was assessed with a "yes" or "no" response to the following question on the CHA survey: "Was telemedicine used during the patient encounter today?" For some subset of encounters in which the otoscope was used, the digital image was also sent to the consulting provider, who then provided consultation via telephone (i.e., "Radio medical traffic"; RMT). Whether this manner of consultation occurred was assessed by a "yes" or "no" response to the following question on the CHA survey: "Did you use Radio Medical Traffic?"

The following variables were considered covariates: patient age and sex, experience and training level of the CHA, and severity of the ear-related problem. Patient age and sex were assessed using the patient survey form. Use of standing medical orders to develop a patient care plan was used as an indicator of the experience level of the CHA (more experienced CHAs using standing medical orders), and was assessed with a "yes" or "no" response to the following question on the CHA survey: "Did you develop a patient care plan with standing medical orders?" The only survey question deemed to be indicative of severity of the case was whether the patient was referred to the regional hospital, with typically only more severe cases being referred. This was assessed with a "yes" or "no" response to the following question from the patient survey: "During your visit today, were you told to travel to the region to see the doctor?"

Statistical Analysis

Chi-square tests of difference between two proportions were run to compare rates of antibiotic dispensing pre- versus post-implementation. For the subset of patient encounters occurring post-implementation, chi-square tests of independence were used to test the association between whether antibiotics were dispensed and both: (a) use of the digital otoscope, and (b) remote consultation. To determine the association between antibiotics being dispensed and both use of the digital otoscope and remote consultation, controlling for the covariates previously described, a logistic regression model was developed. The two predictors of interest were use of the digital otoscope and use of remote consultation. All variables were entered simultaneously into the model, and model fit was assessed using the Hosmer-Lemeshow goodness-of-fit statistic (17).

Results

Of 10,005 patient encounters deemed to be ear-related events during the study period, 3,892 patient forms and 4,277 CHA forms were returned, yielding response rates of 39% and 43%, respectively. Of these, a total of 2,555 patient encounters were described by both patient and CHA, with nonmissing values for key variables, including whether antibiotics were given. Fifty-five percent of these patient encounters were with female patients, and the median age was 4 (ages ranged from less than 1 year to 85 years). This sample (n = 2,555) was significantly older ($P < .0001$) and had more females ($P < .05$) than the sample of total patient encounters (n = 10,005).

Comparison of Pre- to Post-Implementation

Due to unexpected delays with software development, fewer data were collected after the deployment of telemedicine equipment (n = 397) than before (n = 2,158).

Overall, antibiotics were dispensed during 1,753 (67%) of all the ear-related patient encounters. The most frequently given antibiotic was amoxicillin (53% of antibiotics dispensed), followed by trimethoprim/sulfamethoxazole (18%). There was a marginally significant association between antibiotic dispensing and implementation of ENT-related telemedicine equipment such that antibiotics were given out less often after the equipment was in place (64%) compared to before (69%; χ^2 (1, n = 2,555) = 3.71, $\underline{P}$ = .054). The post-implementation sample was significantly older than the pre-implementation sample ($\underline{P} < .001$); there was no difference in the gender composition of the two samples.

Post-Implementation

Antibiotics were dispensed during 256 of 397 patient encounters (64%) post-implementation. The digital otoscope was used by CHAs for 205 of the ear-related patient encounters (52%). Digital images were sent and remote consultations occurred for 177 of the ear-related patient encounters (45%). Bivariate associations between antibiotic dispensing and use of the digital otoscope, remote consultation, and each of several covariates are presented in Table 1.

Due to a measurement artifact, use of the digital otoscope and use of remote consultation were highly correlated; remote consultations based on a digital image occurred only if the digital otoscope had been used. Given this, it was important to assess the independent associations between both variables and dispensing of antibiotics. To do this, while also controlling for potential covariates, a multiple logistic regression analysis was conducted, with all variables entered simultaneously. The resulting model, presented in Table 2, had acceptable fit as indicated by the Hosmer-

Lemeshow goodness-of-fit statistic ($\chi^2(8) = 5.00$, $\underline{P} = .76$). According to the model, use of the digital otoscope, but not the remote consultation with the referral provider, was associated with whether antibiotics were dispensed to the patient by the CHA. Specifically, antibiotics were dispensed less often when the digital otoscope was used during the encounter. In addition, antibiotics were more likely to be given out when: a) patients were younger, b) the CHA relied upon standing medical orders, and c) a referral to the regional medical center was not made. Patient gender was also marginally related to antibiotic dispensing such that female patients were slightly more likely to have been given antibiotics.

Discussion

The present study demonstrated that CHAs dispensed marginally fewer antibiotics for ENT-related patient encounters after ENT-related telemedicine equipment was made available. Examination of just those patient encounters that occurred after implementation of the telemedicine equipment revealed a reduction in antibiotic dispensing related to both use of a digital pneumatic otoscope and use of remote consultations based on the digital images. However, when examined simultaneously, it appears to be use of the otoscope, not reliance on remote consultation, which predicts whether antibiotics are dispensed. Importantly, this association remained after controlling for potential confounders such as patient characteristics, experience of the CHA, and severity of the case.

Study limitations need to be noted before proceeding. First, the present set of findings may not be generalizable outside Alaska, or even to all Alaskan village clinics. Future research is needed to assess the replicability of these findings across

geographical regions and health care systems. Second, we relied on single-source self-reports to indicate use of the digital otoscope, remote consultation, and whether antibiotics were dispensed, as well as each of the possible confounding variables. As with all self-report data, there is the possibility that reality differs from the self-report. Third, given the response rates of 39% and 45% for patient and CHA data respectively, it is possible that there is some non-response bias. The limited patient data available from the DMLs describe a population slightly younger (Median age = 2 years) and less female (53%) than that of the sample of 2,555 (median age = 4 years; 55% female). In addition, age needs to be considered a potential confounder of the marginal association found between implementation and antibiotic dispensing; the marginal drop in antibiotic dispensing from pre- to post-implementation might be due to the significantly older age of the latter population. It is, however, encouraging that the association between otoscope use and antibiotic dispensing among the post-implementation sample remained significant after controlling for age. A final limitation to be noted is that the study was based on correlational data. The staggered interrupted time-series design was used to limit the number of alternative explanations for any findings; however, as with any study other than a randomized clinical trial, caution needs to be taken when interpreting the results.

The finding that those CHAs who relied on standing medical orders, thus were more experienced, were more likely to dispense antibiotics was surprising. It was anticipated that the more experienced health care provider would be more aware of the risks of antibiotic overprescription and more comfortable treating a sick patient without relying on antibiotics. It is possible the less experienced CHAs dispensed antibiotics

less often exactly because of the recency of their training. More veteran CHAs may have been trained prior to the increased awareness of the problems of overprescription, thus may be less wary of relying on antibiotic use. If this is so it may be important to supplement the on-going training of those veteran CHAs to include increased awareness of the problem of antimicrobial resistance.

At first glance it appeared counterintuitive to find that antibiotics were dispensed significantly less often when a case was severe enough to refer to the regional hospital. However, this may simply reflect that CHAs were instructed not to give antibiotics prior to the transfer so as not to interfere with further evaluation and treatment at the hospital. Additional data would be needed to test this hypothesis.

The strong association between using the digital pneumatic otoscope and reduced antibiotic dispensing makes sense considering the otoscope may limit the two most frequently-cited causes for antibiotic overprescription: parental pressure and unclear diagnostic criteria (1,8). Specifically, the digital image may have been used by the CHAs as a tool to educate parents about when antibiotics were and were not needed. In this sense, the digital otoscope might be considered an effective element of a strategy to increase communication between parent and provider. Furthermore, the digital image produced by the otoscope may have provided the CHAs with a larger, clearer, and more prolonged view of the TM, thus increasing their diagnostic accuracy directly. Additional qualitative data on CHAs', patients', and parents' experiences with the otoscope would be useful in testing these hypotheses.

That the simple introduction of a digital pneumatic otoscope into the practice of health care in remote Alaska was associated with less antibiotic dispensing has

implications for the provision of health care in rural areas. It demonstrates that given the opportunity to use better tools, CHAs can potentially do a better job of delivering quality health care. Without assessing important case outcomes, it is impossible to know whether the use of the otoscope was directly associated with better overall care. However, given the current crisis in antibiotic overprescription, a reduction in use of antibiotics is one potential indicator of more judicious use of antibiotics. Future research is needed to assess the extent to which use of a digital otoscope is associated with not just reduced, but more judicious use of antibiotics.

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Table 1. Bivariate associations between antibiotic dispensing and use of digital otoscope, remote consultation, and covariates.

Antibiotics given to patient?	No (n = 141)			Yes (n = 256)			
Variable	n	(%)	M (SD)	n	(%)	M (SD)	Statistic
Otoscope used							54.54***
No	33	17%		159	83%		
Yes	108	53%		97	47%		
Remote consultation							43.16***
No	47	21%		173	79%		
Yes	94	53%		83	47%		
Patient age (in years)			16.94(20.47)			12.15(17.16)	2.48*
Patient sex							2.00
Male	71	39%		110	61%		
Female	70	32%		146	68%		
Standing orders							1.99
No	114	37%		191	63%		
Yes	27	29%		65	71%		

10.73

Table 1. Bivariate associations between antibiotic dispensing and use of digital otoscope, remote consultation, and covariates (Continued).

Antibiotics given to patient?	No (n = 141)			Yes (n = 256)			
Variable	n	(%)	M (SD)	n	(%)	M (SD)	Statistic
Referred to region							15.72***
No	124	33%		250	67%		
Yes	17	74%		6	26%		

*P < .05. **P < .01. ***P < .001.

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Table 2. Logistic regression model predicting antibiotic dispensing.

Variable	B	SE(B)	OR	95% CI
Constant	-1.11	0.58	--	-- --
Otoscope not used (vs. used)	2.20***	0.49	9.01	3.46, 23.46
Remote consultation (vs. not)	0.46	0.46	1.58	0.65, 3.88
Patient age (in years)	-0.02*	0.01	0.98	0.97, 0.99
Patient sex (female vs. male)	0.45+	0.24	1.58	0.99, 2.52
Standing orders (vs. not)	0.75*	0.32	2.11	1.14, 3.93
Referred to region (vs. not)	-1.41**	0.54	0.24	0.09, 0.70

+$\underline{P}$ < .10. *$\underline{P}$ < .05. **$\underline{P}$ < .01. ***$\underline{P}$ < .001.

[1] The term patient will herinafter be used to refer to either the patient or the patient's parent in the case of a minor patient.

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Running head: EMPLOYMENT RETENTION

Employment Retention of Health Care Providers in Frontier Areas of Alaska

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Employment Retention of Health Care Providers in Frontier Areas of Alaska

Abstract

Objectives. The objectives of this study were to: describe the length of employment of health care providers in rural Alaska; assess whether there are differences in length of employment among community health aides, medical doctors, and nurses; and determine whether provider length of employment is significantly increased following implementation of telemedicine.

Data Sources/Study Setting. The Alaska Telemedicine Testbed Project was designed to demonstrate and evaluate the use of narrow bandwidth telecommunications and information technology for telemedicine in rural Alaska. Employment data were collected from four Alaska Native regional health corporations [FRED, WERE THEY PRIVATE SECTOR?].

Study Design. Kaplan-Meier product-limit survival analysis was used to assess employment length. The Mantel-Haenszel log-rank test was used to test the difference between retention (survival) curves among doctors, nurses, and community health aides for all four regional health corporations combined. Data included provider hire date, termination date, and position title.

Results. Fifty seven percent of the data points were right-hand censored. The community health aides (Mdn=1186 days) were retained significantly longer than either the doctors (Mdn=596 days) or the nurses (Mdn=408 days), who were not significantly different from each other (logrank Π^2 (2, N=996)=68.30, p=.0001).

Conclusions. Our findings document that community health aides in the region stay on the job significantly longer than either doctors or nurses. Findings highlight the problem of providing an adequate health workforce in areas such as rural Alaska.

Key Words. Telemedicine, retention, rural health

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Employment Retention of Health Care Providers in Frontier Areas of Alaska

The problems created by staff turnover in the delivery of health care services include both visible costs, such as employee recruitment and advertising expenses, as well as hidden costs, such as those incurred through inefficiencies of departing, interim, and newly hired employees [1, 2]. Inefficiencies caused by provider turnover can diminish both quality and cost-effectiveness of health care delivery [1]. Failure to retain primary care providers, for example, has major fiscal implications for employers and represents a loss of resources that would otherwise be devoted to patient care [3]. Furthermore, staff turnover can impair communication and upset cohesion among members of a work group [4], and lower group cohesion has been found to predict turnover in health care settings [5]. Moreover, the additional workload that staff members may carry during hiring, training, and transition periods may lead to a stressful work atmosphere, which can, in turn, lead to additional turnover, thereby exacerbating the ill effects of staff turnover [6].

Recruitment of health care providers is influenced by preference for particular communities [7, 8], rendering the problem of turnover an even greater concern in rural, medically underserved areas. Research has shown that small, non-metropolitan counties have both lower physician-to-population ratios and growth rates than do metropolitan counties [9]. Despite federal health personnel

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policies of the 1960s and 1970s, designed both to increase the overall supply of physicians and to mitigate maldistribution in underserved, rural areas, chronic shortages in health care providers have persisted in such regions [10]. The lack of enthusiasm among health care providers for working in rural areas has been attributed to lack of adequate medical facilities, professional isolation, limited support services, inadequate organizational settings, excessive workloads and time demands, limited earning potential, lack of social cultural and educational opportunities, and spousal influence [11]. In addition, higher percentages of older physicians practice in non-metropolitan counties, suggesting challenges in retaining rural providers in the future [12]. These problems are anticipated to be most severe in the very smallest counties. It is important, especially in rural areas, to include non-physician providers in considerations of provider supply [12].

There has been a continual problem with retaining qualified health care providers in rural areas of Alaska. In these communities, primary health care is provided in approximately 200 villages by approximately 450 community health aides/practitioners (CHAPs) who receive medical supervision from a physician at a regional medical center, with whom they communicate by telephone. The Alaska Telemedicine Testbed Project, funded by the National Library of Medicine, was designed to demonstrate and evaluate the use of narrow bandwidth telecommunications and information technology for telemedicine in frontier areas of Alaska. The Project developed and deployed telemedicine

workstations for otolaryngology (ENT) assessment at a distance and consultation in frontier areas of Alaska. These areas included 25 remote Native villages, four regional health care facilities, and the Alaska Native Medical Center. Workstations were designed and installed between START-MOMTH, YEAR and END-MONTH, YEAR. The project is described in further detail elsewhere [13].

Telemedicine has been considered a promising strategy for mitigating the problem of health care provider turnover in rural areas, and has been implemented in several demonstration and pilot projects [14-20]. Formally defined as, "the use of electronic information and communications technologies to provide and support health care when distance separates the participants" [21], telemedicine has yielded intriguing findings that bear on provider retention in rural areas. Telemedicine research has shown positive outcomes for the health care workforce [20], and both improved access to health services for rural patients and reduced feelings of professional isolation [16]. Research also has shown that telemedicine can improve patient retention in rural communities [22].

The objectives of this study were to: (1) describe the length of employment of health care providers in frontier areas of Alaska, (2) assess whether there are differences in length of employment among medical doctors, nurses, and community health aides, and (3) determine whether length of employment of health care providers is significantly increased following implementation of telemedicine.

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We hypothesized a mean of 11 months (approximately 330 days) retention time for all healthcare providers. We also hypothesized that the implementation of telecommunications related to telemedicine would increase the retention of health care providers in rural Alaska by decreasing their sense of isolation.

Methods

Sample

Subjects were 996 doctors, nurses, and community health aides employed at four Alaska Native regional health entities located in rural Alaska: Yukon-Kuskokwim Health Corporation (53.5%), Norton Sound Health Corporation (24.9%), Maniilaq Health Corporation (11.9%), and Bristol Bay Area Health Corporation (9.7%). [FRED, ARE THE HEALTH CORPORATIONS PUBLIC, PRIVATE, HMOs, OR OTHER TYPES OF INTEGRATED DELIVERY SYSTEMS?] Of these, 307 were medical doctors (30.8%), 270 were nurses (27.1%), and 419 were community health aides (42.1%). Table 1 presents the distribution of health care worker employment categories by site. The four health care entities included as study sites were selected through open solicitation for all regional health care corporations and member entities of the Alaska Native Health Board in Anchorage Alaska. Approximately 12 of 20 agencies applied. Applications were evaluated in large part based on the number of predicted health care events in order to maximize statistical power for analyses.

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Measures

Administrative data were used in this study. Therefore, data were limited to the information maintained by the participating health agencies. Data collected included hire date, termination date, and position title for all doctors, nurses, and community health aides ever employed at the four health care entities. Data files included current employees as of August 26, 1998.

Procedures

The Alaska Telemedicine Testbed Project was funded by the National Library of Medicine and was designed to demonstrate and evaluate the use of narrow bandwidth telecommunications and information technology for telemedicine in frontier areas of Alaska. Telemedicine workstations were used to provide patients in remote areas with "virtual access" to physicians and specialists.

Analyses. Each of the four health care entities provided a data file including the variables under study for analysis. SAS © software was used to read the data files and to conduct survival analyses [23]. Kaplan-Meier product-limit survival analysis was conducted to model employment length. The Mantel-Haenszel log-rank test available in PROC LIFETEST was used to test the difference between retention (survival) curves between doctors, nurses, and community health aides for all four regional health agencies combined. However, because length of employment retention was greater than anticipated,

it was not possible to compare retention (survival) curves before and after telemedicine implementation. Statistica © software was used to create survival graphs [24].

Results

Slightly more than half of the data points were right-hand censored (that is, employees had not terminated employment by the time of data file construction, August 26, 1998). The community health aides were retained significantly longer (Mdn=1186 days, IQR=2331) than either the doctors (Mdn=596 days, IQR=1125) or the nurses (Mdn=408 days, IQR=736); logrank Π^2 (2, N=996)=68.30, p=.0001. There was no significant difference between the doctors and nurses in terms of length of retention. The Kaplan-Meier retention (survival) curves for each of the three employment categories appear in Figure 1. Comparison of the three curves shows a longer length of retention (days) of community health aides compared to the other two groups. Figure 2 shows box plots with the median employment time and interquartile range by profession. These plots show the higher median length of employment retention, as well as the higher relative interquartile range, for community health aides compared to the medical doctors and nurses.

Discussion

These findings document that community health aides stay on the job much longer than either doctors or nurses. The documentation of short length of

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employment in the regions by both doctors and nurses highlights the problem of providing an adequate health workforce in rural Alaska. Previous research has shown the median tenure for physicians working in federally-funded U.S. community and migrant health centers has been reported to be three years [25]. Our findings document median retention of both doctors and nurses in rural Alaska to be under two years. Policy implications of this study include the fact that the employment retention of nurses is still very short, creating a confluence of problems associated with health care provider turnover in the rural, frontier areas of Alaska.

Community health aides in rural Alaska are generally drawn from the local indigenous population, whereas doctors and nurses are more likely recruited from the larger Alaskan cities (e.g., Anchorage, Fairbanks) or from outside of the state. This pattern would help to account for the longer retention of community health aides in our study. It is believed that cultural familiarity and membership in the local community help indigenous persons overcome the personal, social, and professional barriers responsible for low retention among non-Native health care personnel [26]. Nonetheless, attrition among Native professional and paraprofessional health workers is believed to be high, though poorly documented [26]. Kindig, Schmelzer, and Hong [12] have asserted that regional considerations in addressing retention in nonmetropolitan areas is critical, and that local situations may be difficult to consider from a national

perspective. An important contribution of our study is the documentation of employment and retention patterns for doctors, nurses, and community health aides in rural Alaska. We are not aware of any existing reports of data that address this critical workforce issue in Alaska.

In a recent review of turnover research, Tai, Bame, and Robinson [27] recommended several management strategies to address nursing turnover. These strategies include implementing employee assistance programs, offering a positive work climate, strengthening supervisory support and training programs, enhancing community feedback, providing benefit packages for longer tenure employees, creating opportunities for advancement, and maintaining a stable work environment. These researchers also have emphasized the importance of social support in mitigating turnover [27].

Other research has focused on the National Health Service Corps, a scholarship program designed to increase the supply of physicians in medically underserved areas [28] and the role of physician training [29] in the retention of rural physicians. Because Alaska lacks its own medical school, it, along with two other states, has entered into an educational agreement with the University of Washington School of Medicine. This program, WAMI (Washington, Alaska, Montana, Idaho), provides access for Alaskans to medical education specifically relevant to practice in rural Alaska at reasonable cost, helps to improve the scientific environment at the University of Alaska Anchorage, and offers major

medical school resources to Alaskan health providers [30]. Similarly, the Northern Family Medicine Education (NorFam) Program was developed by the Memorial University of Newfoundland, Canada to provide appropriate training to physicians wishing to work in Northern, remote, or rural communities through the provision of relevant medical training and exposure to Northern cultures [31].

Given the greater job tenure of indigenous community health aides in rural Alaska, their training takes on critical importance. The maintenance of hands-on clinical skills has been a major concern in the on-going training of CHAPS in rural Alaska [32]. In a study of paraprofessional health care workers in rural Canada, native health care workers reported that their professional training left them unprepared for the breadth of demands placed on them in their practice [26]. The authors also assert that a clear understanding of the role of the paraprofessional by community members, employers, and co-workers would improve the retention of paraprofessional health care providers.

Because overall retention time was much longer than hypothesized (about twice the hypothesized length for doctors), we were unable to test our initial hypothesis that access to telecommunications increases the length of employment of healthcare providers in frontier regions, such as rural Alaska. Another limitation of our study is that we were not able to include predictor variables in calculating hazard functions for the three groups of health care

providers. Research on the retention of physicians in community and migrant health centers has incorporated predictor variables in hazard models [25].

In addition to the problems of both health care provider recruitment and retention, access to health care services represents yet another health care problem in rural communities [33]. It has been proposed that telemedicine can ameliorate these problems through four distinct mechanisms: (1) decreasing patient transfers, (2) decreasing providers and patients travel, (3) meeting health care needs of underserved populations, and (4) reducing rural isolation by building knowledge of providers and patients [34]. Telemedicine holds promise in mitigating the related problems of provider recruitment, provider retention, and patient access, and should be developed, implemented, and evaluated in medically isolated and underserved areas, such as rural Alaska.

Acknowledgments

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Figure Legends

Figure 1. Kaplan-Meier employment retention (survival) curves for three categories of health care providers: community health aides, medical doctors, and nurses.

Figure 2. Median employment time by profession with interquartile range (N=996).

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Table 1

Distribution of Health Care Worker Employment Categories by Site (N=996)

	Employment Category					
	Doctors		Nurses		Community Health Aides	
Site	N	%	n	%	n	%
Yukon-Kuskokwim (n = 533)	69	13.0	233	43.7	231	43.3
Norton Sound (n = 248)	45	18.1	95	38.3	108	43.6
Maniilaq (n = 118)	18	15.2	50	42.4	50	42.4
Bristol Bay (n = 97)	13	13.4	56	57.7	28	28.9
Totals	145	14.5	434	43.6	417	41.9

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Figure 1

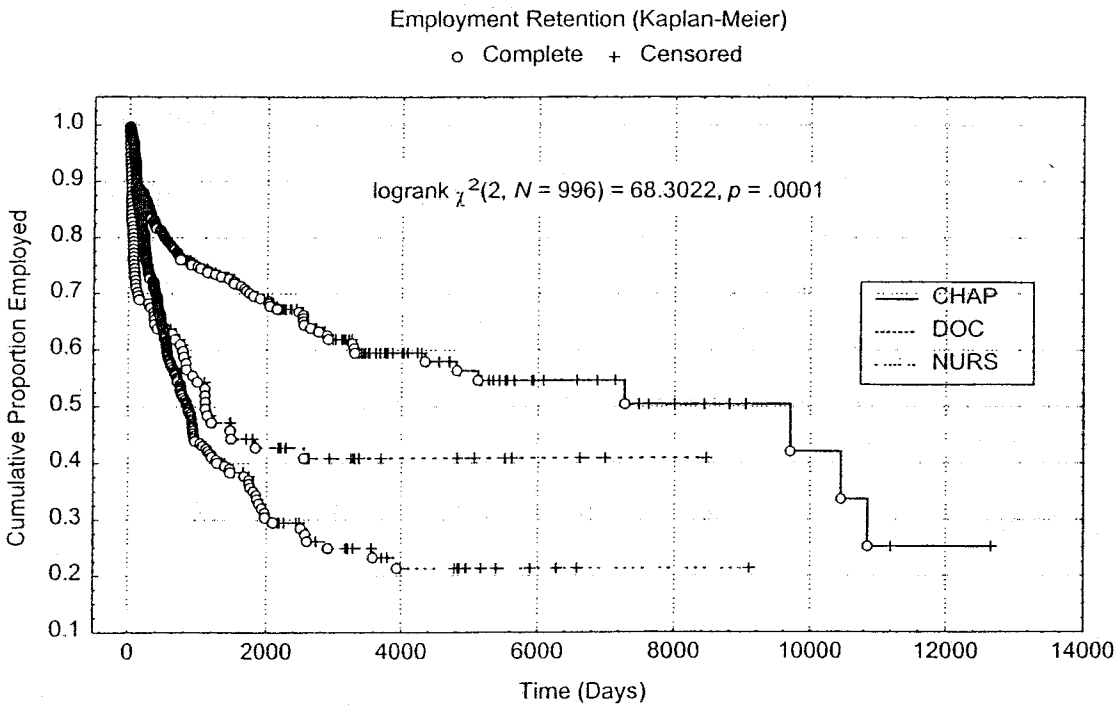

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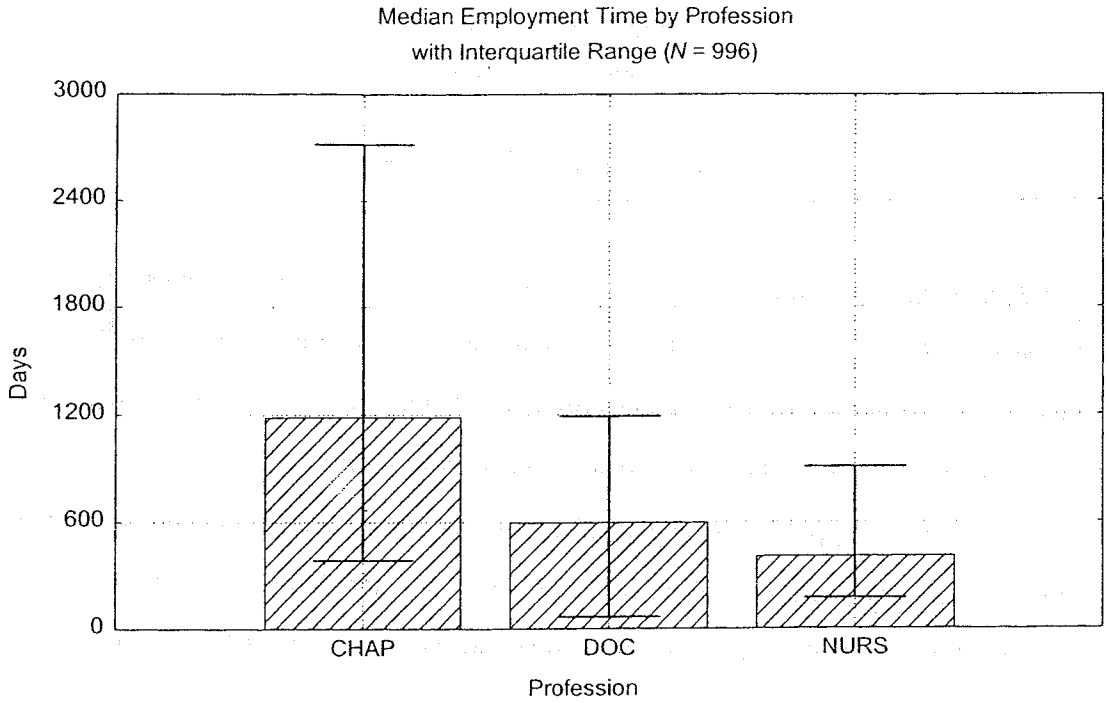
Figure 2


Median Employment Time by Profession
with Interquartile Range (N = 996)
3000
2400
1800
1200
600
0
Days
CHAP
DOC
NURS
Profession

Technology and Managed Care: Patient Benefits of Telemedicine in a Rural Health Care Network*

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Rural health providers have looked to telemedicine as a technology to reduce costs. However, virtual access to physicians and specialists may alter patients' demand for face-to-face physician access. We develop a model of service demand under managed care, and apply the model to a telemedicine application in rural Alaska. Provider-imposed delays and patient costs were highly significant predictors of patient contingent choices in a survey of ENT clinic patients. The results suggest that telemedicine reduced the mean patient loss from rationing of physician access by 46 percent, or about $25 per visit.

JEL classification codes: I110, I180

keywords: rationed markets, health services, managed care, random utility models

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Technology and Managed Care: Patients' Perceived Benefits of Telemedicine in Rural Health Care Delivery Systems

Health care organizations providing managed care, particularly health maintenance organizations (HMO's), often ration patient access to certain services in order to control costs. The existence of queuing and excess demand for these services indicates that at least some patients in a managed care network wish to receive care that is withheld by the provider. The value of the option to utilize withheld care may vary depending on patients' perceived health condition and individual life circumstances.

New technologies and innovative treatment regimes are often among services rationed by managed care providers. On the other hand, technologies that improve care offered by lesser trained personnel may reduce the patients' loss of value from the rationing of access to physicians and specialists at the same time that it facilitates such rationing by the provider. Telemedicine -- the use of electronic information and communication in providing and supporting health care when distance separates the participants (Capalbo and Heggem, 1999) -- is a contemporary example of the latter type of technology.

To date, economic evaluations of cost-saving technologies such as telemedicine have almost exclusively taken the provider's perspective (Kingsley and Grigsby, 2000; Cronin, et al., 1994; Cameron, 1998; McCue, 1998; Zincone 1997). From a public policy standpoint, however, measuring patient (consumer) welfare changes from health care innovations may be at least as important, since public funds heavily subsidize health care services via Medicare and Medicaid reimbursements and provide infrastructure and service delivery support (Capalbo and Heggem, 1999). An innovation that provides a modest cost savings to the provider may involve significant losses in consumer well-

being. An evaluation of social welfare gains of such an innovation must consider patient welfare.

Measurement of patient welfare change from technological innovations in a managed care environment faces two significant methodological challenges. First, a shifting market equilibrium of supply and demand for the affected services can rarely be observed, due to the bundling of services in a managed care package combined with the often limited competition in local markets. The second main tool of empirical economic analysis -- revealed preference -- is likewise compromised, since the nature of managed care is to restrict consumer choice.

In this paper, we address these challenges by developing a method to estimate patient welfare change from a technological innovation in service delivery. We then apply the method to estimate the value of a telemedicine innovation in a rural managed care network. We estimate patients' perceived benefits from a technological innovation as a change in the value of the foregone option to receive care from physicians and specialists whose access is rationed by the provider organization.

Health Care Demand and Managed Care

The standard approach to consumer health economics (Grossman, 1972) derives the household's demand for health care services from a utility function with health, H, and other consumption, O, as arguments: $U = U(H, O)$. Health is uncertain, and depends on the quality of care received, q, a vector $\mathbf{z}$ of personal and household characteristics, and a random factor, ε; i.e., $H = H(q, \mathbf{z}, \varepsilon)$. Economists generally agree that own-price, cross-price, and income elasticities are all non-zero but relatively low. However, quality and time costs -- including travel and waiting times -- are important, and policies that alter these may change use (Capalbo and Heggem, 1999).

Valuing Quality Changes in Rationed Health Markets

Under managed health care programs, consumers generally pay less than the marginal cost of specific services. To limit demand, the provider restricts access to certain health care alternatives. A discrete-choice approach facilitates modeling of demand under this type of rationing.

Economists have been using discrete choice models to analyze consumer behavior in the transportation sector for more than two decades (Ben-Akiva and Lerman, 1985; Domencich and McFadden, 1975). McFadden (1981) provides a comprehensive discussion of the formal assumptions and theoretical properties of discrete choice models. The most important of these may be summarized as follows:

1. Consumers face a known set of alternative choices.
2. The indirect utility of each choice is the sum of a predictable component and a random component uncorrelated with the predictable component.[1]
3. Consumers select the alternative from the set of available opportunities that has the largest expected indirect utility.

We hypothesize that the consumer has available a set of J health discrete care alternatives. Each alternative $j \in J$ has a price (to the patient) of p_j and a perceived quality of q_j. If y represents income, and we assume that all income is expended on H and O, then one can substitute for O and H in the utility function to obtain the conditional indirect utility of consuming the jth health care alternative, $V_j = V_j(y, p_1, ..., p_J, q_1, ..., q_J, z, \varepsilon)$, given the state of nature, ε.

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[1]The random component of utility is assumed to be revealed to the consumer -- and therefore known -- at the time the agent makes the choice, but unobserved by the analyst.

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We introduce rationing of health services by partitioning J into two subsets of alternatives: managed care (J_m) and fee for service (J_f). The consumer's actual choice set at any given instant is specific to the health condition and to the set of available services for treatment. For now, we assume that the prices p_j of alternatives $j \in J_m$ are subsidized to the consumer (who may have paid a fixed cost for the right to access managed care services), while prices p_k of alternatives $k \in J_f$ represent competitive market prices. Given the state of nature, ε, the consumer, if free to choose, reveals her preferences by selecting the alternative with the largest V_j, $\forall\, j \in J$.

Applied welfare analyses usually measure the contribution to utility of a given discrete alternative j in terms of compensating variation, defined as the integral from the market price p_j^0 to infinity of the compensated demand for alternative j as a function of p_j (Small and Rosen, 1981). Let x_m represent the probability that the consumer will choose from among the managed care subset of alternatives, J_m. Suppose we consider two alternatives offered by the managed care provider: 1 and 2. If the consumer could choose freely between alternatives 1 and 2 $\in J_m$, then the compensating variation, or surplus $S_m{}^*$ of managed care given a quality $q_1{}^0$ for alternative 1, under the usual set of restrictive assumptions imposed on the utility function for discrete choice applications,[2] would be:

$$S_m{}^*\left(p_1, p_2, q_1^0\right) = -\int_{p_1^0}^{\infty} x_m\left(V_m\left(p_1, p_2, q_1^0\right)\right) dp_1. \qquad (1)$$

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[2]These assumptions include negligible income effects, a marginal utility of income approximately independent of p_1, and a marginal utility of quality approaching zero as p_1 approaches infinity (Small and Rosen, 1981:124). In addition, the utility function must be well-behaved as defined by Small and Rosen's (1981:112) theorem 1.

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So far we have been assuming that the consumer can freely choose from among alternatives $k \in J_f$. However, the essence of managed care is that the provider chooses which services $j \in J_m$ that the consumer receives. Although the consumer has preferences among managed care alternatives, the choice of alternatives $j \in J_m$ from the consumer's perspective is exogenous and uncertain. If π represents the probability that the managed care provider chooses alternative 2, we may therefore write the consumer's rationed compensating variation, S_m^r, of managed care, as:

$$S_m^r\left(p_1, p_2, q_1^0, \pi^0\right) = -\int_{p_1^0}^{\infty} x_m\left(\left(1-\pi^0\right)V_1\left(p_1, p_2, q_1^0\right) + \pi^0 V_2\left(p_1, p_2, q_1^0\right)\right)dp_1. \quad (2)$$

Suppose a new technology causes the consumer's perceived quality of care in alternative 1 to change from q_1^0 to q_1^1.[3] Small and Rosen (1981) show that the compensating variation for the quality change is:

$$S_m^r(q_1^0, q_1^1) = S_m^r(q_1^1, \pi^1) - S_m^r(q_1^0, \pi^0). \quad (3)$$

If the consumer were instead free to choose among alternatives $\in J$, then the compensating variation for the change in q_1 would be:

$$S_m^*(q_1^0, q_1^1) = S_m^*(q_1^1) - S_m^*(q_1^0). \quad (4)$$

Rearranging terms from equations (1) through (4), we see that the *change* in the consumer's loss from rationing due to the quality shift -- the loss from rationing at $q_1 = q_1^1$ minus the loss from rationing at $q_1 = q_1^0$ -- equals the value of the quality change without rationing minus its value with rationing. That is,

$$S_m^*(q_1^0, q_1^1) - S_m^r(q_1^0, q_1^1) = [S_m^*(q_1^1) - S_m^r(q_1^1, \pi^1)] - [S_m^*(q_1^0) - S_m^r(q_1^0, \pi^0)]. \quad (5)$$

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[3]One way of thinking about new technologies in this context is that they add new alternatives to the choice set. However, it is more useful to think of technologies as changing the quality of care in the patient's existing set of alternatives.

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Since rationing diminishes the utility of the managed care subset of alternatives, $S_m^*(q_1^1) \geq S_m^r(q_1^1, \pi^1)$ and $S_m^*(q_1^0) \geq S_m^r(q_1^0, \pi^0)$. However, we can make no prediction for the sign of $S^*(q_1^0,q_1^1) - S(q_1^0,q_1^1)$.

Random Utility Models of Health Care Demand

The Random Utility Model (RUM) (McFadden, 1981) is a popular form of the discrete choice model that allows one to calculate compensating variation analytically from the estimated indirect utility function. RUM assumes that utility is additively separable into predictable monetary and non-monetary components, and a random component that follows the Type 1 Extreme Value distribution.

RUM suggests that utility is a linear function of health and non-health consumption: $U_j = \alpha_1 H_j + \alpha_2 O_j$. Health consumption is likewise a linear function of quality and individual characteristics: $H_j = q_j + \gamma_j \mathbf{z}_j$. The indirect utility function then becomes a simple linear function:

$$V_j = \alpha_1(q_j + \gamma_j \mathbf{z}_j) + \alpha_2 O_j + \varepsilon_j = \beta_{0j} + \beta_1(Y\text{-}p_j) + \beta_{2j}\mathbf{z}_j + \varepsilon_j. \quad (6)$$

where Y represents household income.[4]

Applications of RUM to health care are relatively recent and limited. Jimenez (1995) reviewed RUM health care demand models for developing countries, where most of the early applications took place. Capalbo and Heggem (1999) and Bockstael (1999) discussed potential difficulties with applying RUM to health care demand. Health care alternatives are likely to differ greatly in cost, quality, and on-site time. Perceived quality differences among alternatives may be important in determining demand; yet defining empirically observable quality attributes presents an empirical challenge. Large quality differences among alternatives also increase the likelihood that the assumption of Independence of Irrelevant Alternatives (IIA) is violated, and highlight the need to define

[4]This RUM model of health demand closely follows Dow (1999).

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the choice set carefully and specify the attributes that matter to consumers. Finally, RUM doesn't easily measure changes in use following price or quality shifts.

Several authors have raised the question of whether income and price elasticities may differ across groups of alternatives for nested models where the upper choice level reflects different types (qualities) of facilities (e.g., urban, rural) (Gertler et al. 1987, 1990; Dow 1999). Relaxing the assumption of constant income and price elasticities would add a subscript to the coefficient β_1 in equation (4), and violate the assumptions of RUM.

Dow (1999) reexamined Gertler et al.'s (1990) Cote d'Ivoire data on illness events, using a nested model in which the upper choice level consisted of urban hospitals, rural clinics, and self-care (residual). Dow obtained a significant coefficient on a term in $(Y\text{-}p)$ squared, suggesting a higher elasticity for clinics than hospitals. He concluded that the marginal utility of income varies with health. Bockstael (1999), however, wondered whether that result would hold with better measurement of price and quality attributes: for example, Gertler (and Dow) defined the price as travel time times average community income.

No discrete-choice models of health services demand in a managed care environment have been estimated for developed nations. The most relevant recent study is that of McNamara (1999). McNamara estimated the demand for rural hospital utilization from U.S. health care survey data using a two-level nested model similar to Dow (1999). He used the model to estimate compensating variation for hypothetical rural hospital closures and service cuts. McNamara defined the price of each alternative as the estimated travel costs, including a wage times the travel time. Unfortunately, he did not observe hospital charges. This is a potentially serious shortcoming, since hospital charges could differ systematically between urban and rural alternatives, leading to the misspecification problem discussed by Bockstael (1999).

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A Telemedicine Application in Western Alaska

We now illustrate the model of quality change for rationed health services under managed care with a telemedicine application in Western Alaska. About 46,000, mostly Alaska Native people live in the region bordering the Bering and Chukchi Seas.[5] Health care was historically provided to the region by the federal Indian Health Service, operating from regional hospitals and clinics in Kotzebue, Nome, Bethel, and Dillingham. However, nearly 70 percent of the residents of the region live in small communities that are not connected by road to the regional centers. Primary health care in these rural communities is available only from Community Health Practitioners (CHPs) with little formal medical training, under the supervision of remote physicians. Patients needing urgent care are referred by a physician to travel by small plane to the nearest regional hospital/clinic.

During the 1990s, the Indian Health Service transferred responsibility and funding for the rural Alaska Health system to Native organizations under contracts that provide a fixed dollar amount per year per eligible enrollee. Basic health care is provided as an entitlement to Native Americans, but providers regularly seek reimbursement from Medicaid and third-party insurers. There are no other hospitals and very few independent physicians in the region. Patients needing specialty care are flown to Anchorage for treatment at the Alaska Native Medical Center. When patients are referred by a physician for travel, all expenses, including costs for child's a parent or guardian, are paid by the provider.

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[5]Alaska Department of Labor, 1999 estimates, comprising the Dillingham, Bethel, Wade Hampton, Nome census areas, and the Lake and Peninsula and Northwest Arctic Boroughs.

Figure 1 illustrates the treatment protocol for a typical patient seeking health services in a small rural community. If the CHP does not have standing orders from a supervising physician to treat the set of observed symptoms, she consults by long-distance telephone with a physician at the regional clinic at a designated time each day.[6] The provider organization rations services by limiting direct patient access to physicians and specialists.

Although the private clinics are virtually absent in the region, small community residents can pay for their own travel to their provider's regional health clinic. Walk-in patients coming to regional clinics without physician referrals would typically be evaluated initially by a registered nurse practitioner or physician's assisitant -- primary care professionals with much more training and expertise than the CHPs. Travel without reimbursement to the regional clinic thus provides an analogy to the fee-for-service option, with the travel cost substituting for the private clinic fee.

Telemedicine demonstration project

From 1997 to 1999, the four main health care providers in the region participated in a project to demonstrate the feasibility of a basic telemedicine technology. The demonstration project targeted ear conditions -- a major medical problem in rural Alaska, particularly among children -- and was designed to use the existing telecommunications infrastructure in the 26 participating small communities. Equipment at the rural community consisted of a digital photographic otoscope, a personal computer, and a modem. CHPs captured digital pictures of the patient's ear canal with the otoscope, transmitting the image along with other patient information via electronic

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[6]Communities in the region began to receive telephone service in the late 1970s. Before rural clinics had telephone service, CHPs consulted with physicians using two-way radio.

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mail to the server at the respective regional facility. Physicians would then download the messages from the server and view the images on their office personal computers.

This simple technological upgrade potentially improves the quality of care received by rural ear patients in a number of ways. It greatly increases the amount and quality of information available to the physician involved in a remote consultation. It improves communication between the physician and the CHP, since they both can be viewing the same image during the telephone consultation. Over the long term these telemedicine-enhanced consultations provide professional development for the CHP in diagnosing and treating a common ailment. Finally, the equipment empowers the patient -- or commonly, the child patient's parent -- to view the inside of the ear as the image is taken.

Patients and practitioners involved in the demonstration project answered a series of survey questions about their experiences with the technology. Four separate survey populations were interviewed: (1) patients at community clinics, (2) patients at regional clinics, (3) CHPs at community clinics, and (4) physicians at regional clinics.[7] All surveys were initiated several months -- up to a year in some cases -- before the telemedicine technology was implemented in order to collect baseline data. All ear patients and practitioners filled out written questionnaires at the end of each patient visit.

Patient questions included basic demographic information and attitudes toward care received, and preferences to travel to receive care. Patients surveyed in community CHP clinics provided simple yes or no responses to questions about preferences to travel to the regional clinic to see a physician under varying time delay and cost conditions. Community clinic patients who indicated that they would have preferred to

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[7] In addition to these four surveys, a consulting ENT specialist in Anchorage also filled out survey forms. However, data from this survey are not used in the current analysis.

travel to receive care if travel costs were paid and there were no delay were asked to indicate if they would still have preferred to travel in each of the following four hypothetical situations: (1) travel if paid but 1 week delay, (2) travel if paid but 2 week delay, (3) travel if paid but 1 month delay, (4) travel if the patient had to pay for travel, but no delay.

Patients surveyed in regional clinics were asked whether or not they had traveled from another community and whether or not they were referred to the clinic (with travel reimbursed). Health care provider surveys included questions about perceived skills and ability to meet the patient's needs, whether antibiotics were prescribed for the ear problem, and about attitudes toward the telemedicine technology.

Data from a separate source -- the daily medical logbook maintained by the provider organizations for case management -- provided an independent check on the response rate for the surveys. This source suggested that the response rate was around 45 percent, with no significant change after telemedicine was implemented. After the survey data had been collected, we matched the data from the patient to the practitioner's data using a unique patient identifier and the date of the clinic visit, yielding data on about 4,000 visits from about 2,000 patients.

Table 1 provides descriptive statistics for the survey questions used in the analysis. The patients in three-fourths of the observations were children younger than 13; most of the data consequently relate to preferences of the parents of these young children. Over 60 percent of patients indicated that they preferred to receive treatment at the community clinic that day, suggesting that nearly 40 percent experienced some loss from rationing of access to physicians. Only about 4 percent of patients actually were referred for travel to see a physician after screening at the community clinic.

Theoretically, one might hypothesize that improving the quality of health care with telemedicine technology could increase the overall demand for services. In this case,

however, there is no evidence that the rate of clinic visitation for ear problems changed after telemedicine was implemented.[8] Table 1 shows that the percent of patients referred for travel actually increased slightly after telemedicine was implemented, suggesting that the demonstration project did not reduce provider costs. Thus potential gains to society from introducing the technology, if any, must accrue in the form of patient benefits.

Empirical methods

The main empirical task is to estimate an equation for the demand for managed care health services, x_m, to substitute into equations (1) through (4). In principle, one could estimate x_m from observing patient choices among the unrationed managed care and fee for service alternatives, even if providers ration some managed care alternatives. Because of the high cost and logistics of the requisite air travel, however, residents of small communities in our empirical application rarely chose the option corresponding to a fee-for-service alternative. Of 4,065 patient-initiated clinic visits from residents of participating small communities, only 60 -- less than 1.5 percent -- occurred at a regional center. The remaining 98.5 percent occurred at the community health clinic. Given the large number of demographic and clinical factors potentially affecting preferences for travel on a given choice occasion, the data on observed choices provide too little variation to estimate a stable equation for x_m. Consequently, while the choice to pay to travel to the regional clinic technically remains in the choice set, we must seek additional information to estimate a demand relationship.

Fortunately, the survey responses to questions about contingent preferences to travel to see a physician -- a rationed alternative under managed care -- provide an ideal

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[8]Average monthly clinic visits per community changed from 9.45 before implementation to 7.85 afterwards, but the change was not statistically significant.

dataset with which to measure demand. This contingent preference information is critical in our case, since the provider always requires the patient to undergo screening by the CHP before approving travel to see a physician. That is, the provider always chooses alternative 1 ($\pi^0 = \pi^1 = 0$).

The patient therefore has three potential alternatives -- (1) CHP clinic (unrationed), (2) travel to see physician (rationed), and (3) travel to regional clinic (unrationed) -- but is nearly always observed to choose alternative 1. To estimate x_m in equations (1) and (2), we assume that individual i's probabilistic demand for alternative k among three alternatives, assuming no rationing, is:[9]

$$x_{ik} = \frac{e^{V_{ik}}}{\sum_{j=1}^{3} e^{V_{ij}}}. \qquad (7)$$

The indirect utility function, V_i follows the general form of equation (6), but explicitly includes perceived quality attributes that might vary among respondents for the same alternative, or vary over time. For example, the time delay for treatment is a critical element of quality for a rationed service.

We combine information on the conditional preferences for option 2 from contingent choice questions with the observed unconditional choices of the regional clinic option 3 (fee-for-service analogue). We observe a dichotomous variable y_{ik} indicating a conditional preference to travel to receive care:

---

[9]Equation (7) assumes three independent alternatives. For some applications, a nested model may be more appropriate, with managed care and fee-for-service alternatives forming separate branches of the decision tree. In our case, however, the nested model cannot be distinguished empirically from the simpler independent model.

$$y_{ik} = 1 \quad \text{if } V(p_{ik}, d_{ik}, \mathbf{z}_i) + \varepsilon_i \geq V_{i1}(0, 0, \mathbf{z}_i);$$
$$y_{ik} = 0 \quad \text{otherwise,}$$

where V is the indirect utility for patient i of travel with a given cost p_{ik} and delay d_{ik} for alternative $k = 2$ or 3, and V_{i1} is the utility of receiving free and timely care at the CHP clinic.[10]

Normalizing V_{i1} to zero, the probability that the individual prefers to travel may be written:

$$x_{ik} = \text{prob}(y_{ik} = 1 | p_{ik}, d_k, \mathbf{z}_{ik}) = \frac{e^{V(p_k, d_k, z_{ik})}}{1 + e^{V(p_k, d_k, z_{ik})}} = \frac{e^{\alpha p_{ik} + \beta d_k + \gamma z_{ik}}}{\left[1 + e^{\alpha p_{ik} + \beta d_k + \gamma z_{ik}}\right]}. \tag{8}$$

We estimate equation (8), and substitute the estimated parameters for V_2 and V_3 back into equation (7) to obtain the estimated unconditional demand.

We measure travel cost as the sum of transportation, food and lodging costs. All transportation between communities and the regional clinic takes place by air. Travel times are relatively short -- typically less than one hour -- and vary little, but costs vary greatly across communities. We used published fares for air transportation costs. We used survey averages for trips to each regional clinic for the non-transportation component of costs. Data for the **z** variables are derived from survey questions about the patient's perceived health condition as well as individual and household demographic characteristics, as summarized in Table 1.

Results

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[10]Since the questionnaire was administered after the clinic visit was completed, atients' responses consider information about the medical condition and quality of care obtained during that visit.

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Table 2 shows the estimated parameters of equation (8) estimated using maximum likelihood techniques. Appendix A describes the details of the estimation procedure. The equation fits the data well and the coefficients appear reasonable. In particular, the coefficients for the time delay and travel cost are both negative and highly significant, reflecting the ability of the survey's multiple-question protocol to bound respondents' preferences with precision.

The second set of columns includes three additional variables from the merged CHP survey that provide information on the quality of care received on that visit. CHP use of standing orders was associated with an increased preference for travel, while prescription of an antibiotic reduced travel preferences. Consultation with a physician (radio medical traffic) had no effect, unless the physician referred the patient to travel for treatment. Referral for treatment had a strong positive effect on travel preferences, suggesting that patients -- or parents of child patients -- strongly disfavor rationing of access to physicians when its only effect is to delay treatment.

Three dummy variables in Table 2 describe the effects telemedicine on the demand for the travel alternatives. A dummy equal to one post implementation is strongly negative, a dummy equal to one if telemedicine is used is strongly negative, and a dummy for physician referral to travel post implementation is also positive. The net effect of the three variables is therefore ambiguous in Table 2, and depend on how the equipment was used.

Telemedicine equipment was actually used for only 53 percent of the ear cases after it was available. Table 3 shows the results of a logit equation estimated for the probability that telemedicine was used when it was available. Use of telemedicine equipment was not correlated with CHP perception of adequacy of training, level of confidence in job skills, or job satisfaction. Instead, it appears that learning by doing and

capacity constraints -- it takes the CHP extra time to take and send the images -- explain the variation in use.

We substitute health care demand equations (7) and (8), using the parameters shown in Table 2, into equations (1) and (2), and evaluated the integrals to estimate compensating variation with and without telemedicine. Table 4 provides the compensating variation estimates for the three study alternatives services at the two different quality levels. The figures in the table suggest that availability of the CHP clinic for an ear ailment is worth on average about $400 at $q_1 = q_1^0$ (without telemedicine). Placing this relatively high value in perspective, we note that health care is provided free of charge, alternatives are remote and costly, and most observations reflect parents values on behalf of their children. Telemedicine adds about 20 percent to this value, increasing managed care patients' perceived health care benefits by over $100 per visit.

The value of travel to see a physician, if patients were given the choice, averages $65 without telemedicine, declining to $54 with telemedicine. In this rural Alaska managed care case, the technological innovation increases the value of the provided service and reduces the value of the rationed service. Considering alternatives 1 and 2 combined, introduction of telemedicine reduces the patient's average loss from service rationing from $54 to $29 per visit.

Table 4 also shows for reference the estimated compensating variation of alternative 3 -- travel to the regional clinic -- with and without rationing. This analogy to the fee-for-service alternative has relatively little value to patients, given their other care options. Rationing access to physicians causes this value to increase from $3 to $4, and introduction of telemedicine has relatively little effect.

Conclusions

We have discussed how introduction of new health care technology may reduce patients' losses from rationing of services by managed care providers as it increases patients' overall benefits. In a case study of rural Alaska clinic visits for ear ailments, we estimate that a telemedicine innovation increased estimated patient benefits by about 20 percent, and reduced the estimated loss from rationing of access to physicians by 46 percent.

The benefits estimated in this rural Alaska case may not represent the experience with other technological innovations in other places. In particular, patients may experience net losses for telemedicine innovations that are accompanied by increased service rationing: for example, if telepsychiatry replaces face-to-face contact. In general, we note that careful empirical research is likely to confirm that technological innovation in health care service delivery causes complex changes to patient-provider relationships and quality of care, especially in a managed care environment. Case-by-case research will be needed to assess how patients benefit from these innovations.

Appendix A. Estimation Methods

Assuming utility is concave in its time and money arguments, we can divide the potential response combinations into 6 preference categories:

We define y_k for k=0,1,2,...,5, as follows:

y_0 1 if patient traveled to regional clinic (p=p), 0 otherwise (contingent preferences not ascertained)

y_1 1 if yes if travel unpaid (p=p_i), yes if paid (p=0) and max delay (d=d_{max}), 0 otherwise

y_2 1 if yes if travel unpaid (p=p_i), yes if paid (p=0) and a delay ($d_1 \geq 0$), no to a larger delay ($d_2 \leq d_{max}$), 0 otherwise

y_3 1 if no if travel unpaid (p=p_i), yes if paid (p=0) and max delay (d=d_{max}), 0 otherwise

y_4 1 if no if travel unpaid (p=p_i), yes if paid (p=0) and a delay ($d_1 \geq 0$), no to a larger delay ($d_2 \leq d_{max}$), 0 otherwise

y_5 1 if no if travel paid (p=0) and no delay (d=0), 0 otherwise

where d is the hypothetical delay, in weeks (d_{max} = 4).

The conditional probability of each of the five contingent preference outcomes given the choice to visit the local CHP clinic (y_0=0) may therefore be written as follows:

$$\pi(y_1) = \pi(y_{pi}|p_i, 0)\,\pi(y_{di}|0, d_{max})$$

$$\pi(y_2) = \pi(y_{pi}|p_i, 0)\,\pi(y_{di}|0, d_1)\left(1 - \pi(y_{di}|0, d_2)\right)$$

$$\pi(y_3) = \left(1 - \pi(y_{pi}|p_i, 0)\right)\pi(y_{di}|0, d_{max}) \qquad (9)$$

$$\pi(y_4) = \left(1 - \pi(y_{pi}|p_i, 0)\right)\pi(y_{di}|0, d_1)\left(1 - \pi(y_{di}|0, d_2)\right)$$

$$\pi(y_5) = 1 - \pi(y_1) - \pi(y_2) - \pi(y_3) - \pi(y_4)$$

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The log likelihood function is therefore

$$\text{Log}\, L = \sum_i y_{0i} \log \pi(y_{0i}) + \sum_i (1 - y_{0i}) \log(1 - \pi(y_{0i}))$$

$$+ \sum_i (1 - y_{0i}) \sum_{k=1}^{5} y_{ki} \log \pi(y_{ki}). \tag{10}$$

Substituting for $\pi(y_{ki})$ from equation (7), we have:

$$\begin{aligned}
\text{Log}\, L = {} & \sum_i y_{0i} \log(\Lambda(\alpha p_i + \gamma \mathbf{z}_i)) + \sum_i (1 - y_{0i}) \log(1 - \Lambda(\alpha p_i + \gamma \mathbf{z}_i)) \\
& + \sum_i (1 - y_{0i}) \{ y_{1i} [\log(\Lambda(\alpha p_i + \gamma \mathbf{z}_i)) + \log(\Lambda(\beta d_{\max} + \gamma \mathbf{z}_i))] \\
& + y_{2i} [\log(\Lambda(\alpha p_i + \gamma \mathbf{z}_i)) + \log(\Lambda(\beta d_1 + \gamma \mathbf{z}_i) - \Lambda(\beta d_2 + \gamma \mathbf{z}_i))] \\
& + y_{3i} [\log(\Lambda(\gamma \mathbf{z}_i) - \Lambda(\alpha p_i + \gamma \mathbf{z}_i)) + \log(\Lambda(\beta d_{\max} + \gamma \mathbf{z}_i))] \\
& + y_{4i} [\log(\Lambda(\gamma \mathbf{z}_i) - \Lambda(\alpha p_i + \gamma \mathbf{z}_i)) + \log(\Lambda(\beta d_1 + \gamma \mathbf{z}_i) - \Lambda(\beta d_2 + \gamma \mathbf{z}_i))] \\
& + (1 - y_{1i} - y_{2i} - y_{3i} - y_{4i}) \log(1 - \Lambda(\gamma \mathbf{z}_i)) \}
\end{aligned} \tag{11}$$

where $\Lambda(\cdot)$ is the (cumulative) logistic distribution.

The log likelihood function in equation (10) is a linear combination of logistic log likelihoods, and is therefore globally concave. Equation (10) bears some resemblance to the likelihood functions estimated for the multiple-bounded dichotomous-choice contingent valuation literature (Cameron, 1988; Hanneman et al., 1991). However, the dependent variables relate to a set of contingent behavior questions rather than to take-it-or-leave-it bid amounts. Instead of measuring willingness to pay directly from the estimated equation, we invoke RUM to estimate a willingness to pay indirectly using equations (5) and (6).

To estimate $S^*(q_1^0, q_1^1)$ in equation (5), we use the fact that $x_1 + x_2 = 1$, since they represent conditional probabilities, given the choice of the managed care option. Thus,

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suppressing the individual subscript *i*, algebraic transformation of equation (7) yields an equation for x_1 that can be integrated directly:

$$x_1(V_1(p_1, p_2, q_1)) = \frac{e^{-V(p_1,p_2,q_1)}}{1+e^{-V(p_1,p_2,q_1)}}, \tag{12}$$

$$S^*(q_1) = -\int_{p_1^0}^{\infty} x_1(V_1(p_1, p_2, q_1))dp_1 = -\log\left[1+e^{-V(p_1^0,p_2,q_1)}\right]. \tag{13}$$

To estimate $S(q_1^0,q_1^1)$ in equation (6), we assume an infinite price for alternative 2 that yields a zero demand:

$$S(q_1) = -\int_{p_1^0}^{\infty} x_1(V_1(p_1, \infty, q_1))dp_1 = S^*(q_1) - \left[-\int_{p_2^0}^{\infty} x_2(V_2(p_1, p_2, q_1))dp_1\right]$$

$$= S^*(q_1) - \log\left[1+e^{V_2(p_1^0,p_2,q_1)}\right]. \tag{14}$$

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Table 1. Descriptive Statistics of Study Variables

Variable	*Mean*	*Std. Dev.*	*Minimum*	*Maximum*	*Valid cases*
Maximum delay (weeks)	1.64	1.55	0	4	1674
Minimum delay (weeks)	0.71	1.28	0	5	3433
Airfare to region	154.90	72.50	0	560	4055
Total travel cost	383.10	128.50	119	1144	3928
Patient referred to travel	3.8%	19.1%	0	1	3768
Telemedicine implemented	13.3%	33.6%	0	1	4065
Telemedicine used	7.6%	26.5%	0	1	4005
Patient's age	11.2	15.6	0.0	85.6	3928
Female patient	55.8%	49.7%	0	1	3922
Child under 13	75.5%	43.0%	0	1	3928
Teen: aged 13-17	4.0%	19.6%	0	1	3928
Elder: aged 60+	1.6%	12.7%	0	1	3928
Adult aged 18-59	18.8%	39.1%	0	1	3928
y0[a] (traveled to region)	1.5%	12.1%	0	1	4065
y1[a] (always preferred travel)	4.5%	20.8%	0	1	4005
y2[a] (would travel if no delay)	10.3%	30.4%	0	1	4005
y3[a] (would travel if paid)	4.7%	21.3%	0	1	4005
y4[a] (travel if paid, no delay)	16.6%	37.2%	0	1	4005
y5[a] (never preferred travel)	63.9%	48.1%	0	1	4005
Standing orders used[b]	1.57	0.49	1	2	3735
Radio medical traffic used[b]	1.69	0.46	1	2	3750
Antibiotic prescribed	57.8%	49.4%	0	1	4005
CHP adequate training[c]	1.26	0.47	1	5	3781
CHP confident in skills[c]	1.22	0.43	1	5	3778
CHP satisfied with job[c]	1.21	0.45	1	5	3781
ENT patients seen that day	2.61	2.76	0	25	4065

[a]See Appendix A for complete definition.
[b]1=No, 2=Yes.
[c]Self-assessed on a five-point Likert cale: 1=complete agree, 5=completely disagree.

Table 2. Logit Equations for Patient Preference to Travel to Receive Care

(Maximimum Likelihood Estimates)

Variable	*Coefficient*	*t-ratio*
Money cost	-0.0039	-33.07 ***
Delay (weeks)	-0.5631	-39.94 ***
CHP clinic constant	-0.0236	-0.09
CHP post implementation	-1.1551	-9.24 ***
Referred to travel	1.0919	7.63 ***
Telemedicine used	1.3083	9.15 ***
Referred: increment with telemedicine	0.6619	1.90 *
Regional clinic constant	-2.7958	-10.54 ***
Child under 13	0.5344	2.38 **
Age 13-17	4.4224	3.34 ***
Age 60 +	7.9391	2.82 ***
Female adult	-0.4783	-3.84 ***
Adult age	0.0149	2.71 ***
Child's age	-0.0425	-5.14 ***
Teen's age	-0.2467	-2.88 ***
Elder's age	-0.1107	-2.63 ***
Monthly trend	-0.0325	-5.22 ***
Standing medical orders	0.1220	2.20 **
Radio medical traffic	0.0205	0.34
Antibiotic prescribed	-0.2110	-4.20 ***
Number of observations	3432	
Log-Likelihood	-5912	
Wald Statistic	3599	

* p<.10
** p<.05
*** p<.01

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Table 3. Logit Equation for Likelihood Telemedicine Used When Available
(Maximimum Likelihood Estimates: Community Fixed Effects Not Shown)

Variable	*Coefficient*	*Std. Error*	*t-ratio*
Monthly trend	0.3539	0.0872	4.060 ***
CHP adequate training	0.9826	0.8206	1.197
CHP confident in skills	-1.0965	0.9961	-1.101
CHP satisfied with job	0.3606	0.8962	0.402
Reciprocal of number of cases	1.0557	0.4613	2.289 **

Number of observations		535
Log-Likelihood	at convergence	-202.5
	initial (slopes=0)	-370.5
Likelihood Ratio Chi-squared(25)		336.0

** p<.05
*** p<.01

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Table 4. Estimated Compensating Variation for Rural Alaska Health Services: With and Without Telemedicine

(Evaluated for period with telemedicine implemented: 497 observations)

Alternative	Without telemedicine: $q_1 = q_1^0$	With telemedicine: $q_1 = q_1^1$	Difference
CHP clinic (alternative 1)			
unrestricted: S^*	$399.00	$495.30	$96.30
physician access rationed: S^r	410.20	520.20	110.00
Physician option (alternative 2)			
unrestricted: S^*	65.40	53.90	-11.50
physician access rationed: S^r	0	0	0
Total, alternatives 1 and 2			
unrestricted: S^*	464.40	549.20	84.80
physician access rationed: S^r	410.20	520.20	110.00
loss from rationing: $S^* - S^r$	54.20	29.00	-25.20
Travel to regional clinc (alternative 3)			
unrestricted: S^*	3.00	3.20	-0.20
physician access rationed: S^r	4.00	4.00	0.00
Total, all alternatives			
unrestricted: S^*	467.40	552.40	84.60
physician access rationed: S^r	414.20	524.20	110.00
loss from rationing: $S^* - S^r$	53.20	28.20	-25.40

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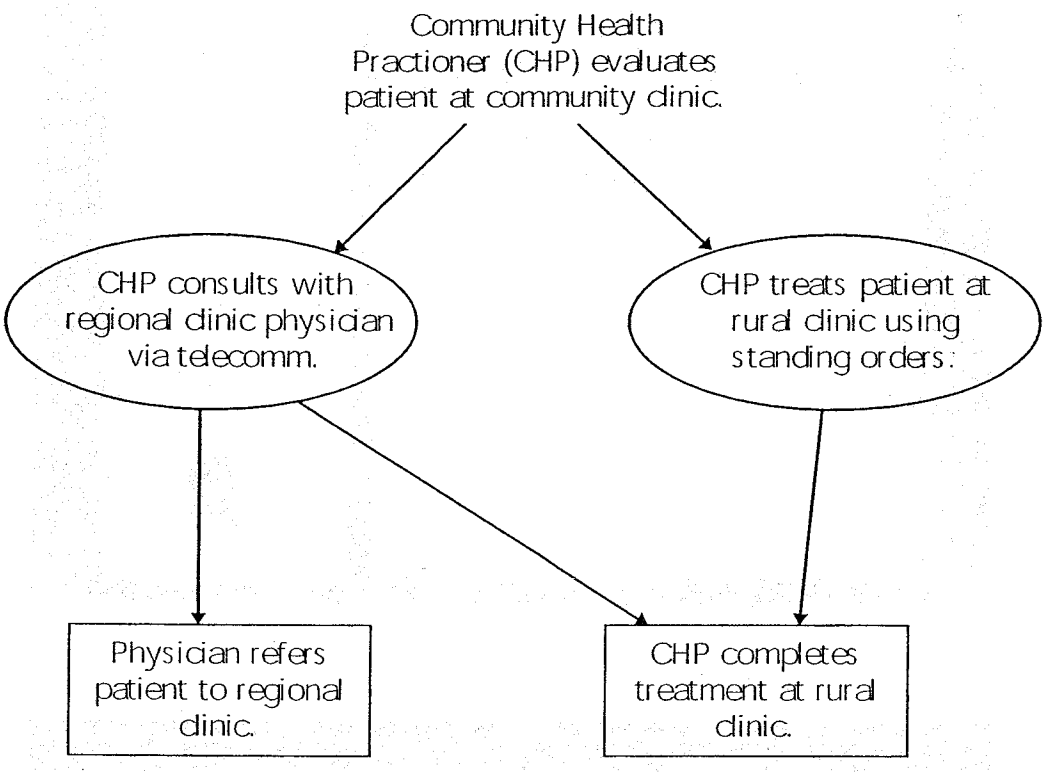
Figure 1. Typical Treatment Protocol for a Rural Alaska Community Clinic



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Narrow Bandwidth Telemedicine in Alaska

- **Frederick W. Pearce,Ph.D.**
  - **Dir., Applied Sciences Laboratory, UAA**

PTC Presentation

Alaska Telecommunications

Alaska Telemedicine Project

NLM Contract Goals

NLM Contract Phase I

NLM Contract Phase II

NLM Contract Evaluation

ALASKA TELEMEDICINE TESTBED PROJECT #N01-LM-6-3540

Project Background

- Alaska is **BIG**, really **BIG**
- Juneau, Anchorage, Fairbanks information corridor
- 150,000 people live in "rural" Alaska
- 46% of rural Alaskans are Native Alaskans
- Small isolated village health care clinics accessible only by aircraft

PTC Presentation

Alaska Telecommunications

Alaska Telemedicine Project

NLM Contract Goals

NLM Contract Phase I

NLM Contract Phase II

NLM Contract Evaluation

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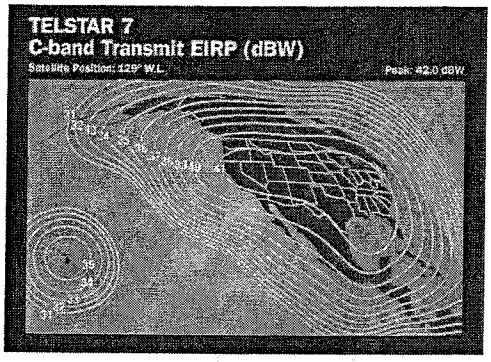
Satellite Footprint



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NLM Contract Evaluation

ALASKA TELEMEDICINE TESTBED PROJECT #N01-LM-6-3540

Alaska Telecommunications

- Juneau, Anchorage, Fairbanks information corridor similar to most cities in U. S. except that switched digital services are still unavailable!
- 9.6 kb TCP/IP connectivity to some larger villages and rural "hubs" like Bethel, Dillingham, Kodiak, Barrow, Glenallen
- 2.4 kb dial-up connectivity to village health clinics like Old Harbor and Stebbins

PTC Presentation

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Alaska Telemedicine Project

NLM Contract Goals

NLM Contract Phase I

NLM Contract Phase II

NLM Contract Evaluation

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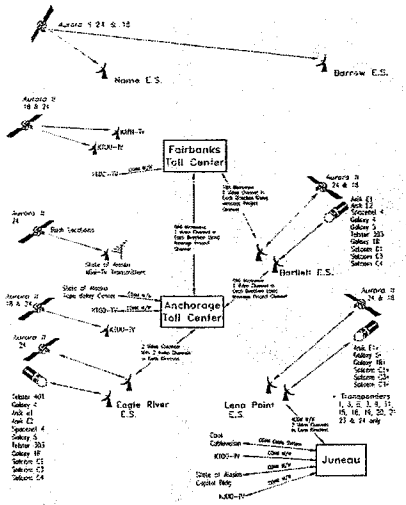
Alaska Telecommunications Network



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NLM Contract Phase II

NLM Contract Evaluation

ALASKA TELEMEDICINE TESTBED PROJECT #N01-LM-6-3540

Alaska Telecommunications

- Implications and timeline for the Healthcare Provisions of the Telecommunications Act of 1996 are still uncertain
- Section 254 promises to improve connectivity and change "distance-based" cost structure; but...
- AT&T Alascom, GCI, Inc., and ATU Telecommunications will improve bandwidth capabilities

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Alaska Telecommunications

Alaska Telemedicine Project

NLM Contract Goals

NLM Contract Phase I

NLM Contract Phase II

NLM Contract Evaluation

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The Alaska Telemedicine Project

- Conceived in 1994 as a "loose" consortium and lead by UAA and PHSA
- 62 "official" partners in Alaska, the Russian Far East, and elsewhere
- Native, military, and civilian participation
- Current projects include a Providence Health System in Alaska sponsored seven site satellite-based teleradiology project; a statewide informatics project with 1,600 users; needs assessment project

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Alaska Telecommunications

Alaska Telemedicine Project

NLM Contract Goals

NLM Contract Phase I

NLM Contract Phase II

NLM Contract Evaluation

ALASKA TELEMEDICINE TESTBED PROJECT #N01-LM-6-3540

The Alaska Telemedicine Project

- Demonstration of video teleconferencing by Third Medical Group at Elmendorf AFB finds video teleconferencing technology "unworkable" in Alaska at this time
- Project members adopt various "store and forward" applications as basic model. This includeds MDTV on the "high" end
- Currently partners have six "outside" funded telemedicine projects (Bethel, North Slope Borough, Yukon Flats, Glenallen, Juneau, UAA)

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Alaska Telecommunications

Alaska Telemedicine Project

NLM Contract Goals

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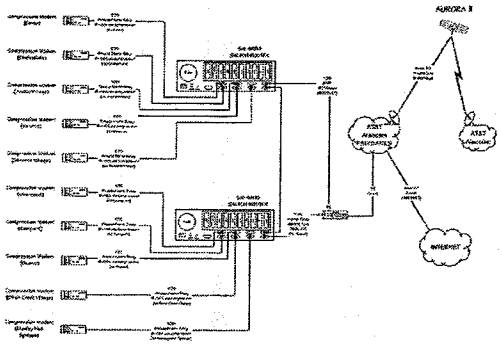
ALASKA TELEMEDICINE TESTBED PROJECT

#N01-LM-6-3540

AT&T Alascom Proposed System for Yukon Flats



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- Alaska Telecommunications
- Alaska Telemedicine Project
- NLM Contract Goals
- NLM Contract Phase I
- NLM Contract Phase II
- NLM Contract Evaluation

ALASKA TELEMEDICINE TESTBED PROJECT

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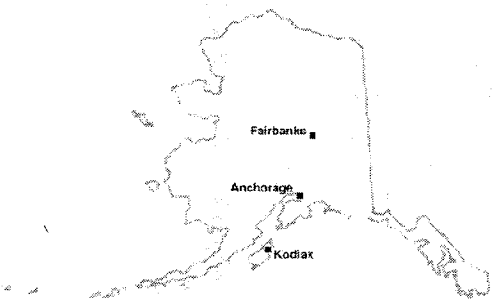

Alaska Telemedicine Project
3rd Medical Group / Elmendorf Air Force Base

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PTC Presentation

- Alaska Telecommunications
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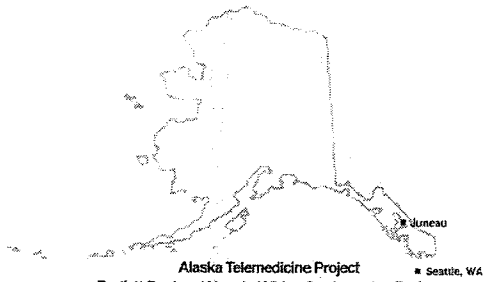

Alaska Telemedicine Project
Bartlett Regional Hospital Video Conferencing Project

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Alaska Telecommunications

Alaska Telemedicine Project

NLM Contract Goals

NLM Contract Phase I

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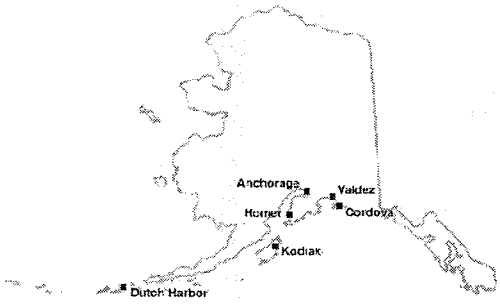

Alaska Telemedicine Project / Providence Teleradiology Project

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Alaska Telecommunications

Alaska Telemedicine Project

NLM Contract Goals

NLM Contract Phase I

NLM Contract Phase II

NLM Contract Evaluation

NLM Contract Goals

- Identify and implement narrow-bandwidth telemedicine and telehealth technologies and applications capable of being implemented, supported, and sustained in "rural" Alaska
- Evaluate the impact of narrow bandwidth telemedicine technologies and applications on the delivery of health care in rural Alaska

PTC Presentation

Alaska Telecommunications

Alaska Telemedicine Project

NLM Contract Goals

NLM Contract Phase I

NLM Contract Phase II

NLM Contract Evaluation

ALASKA TELEMEDICINE TESTBED PROJECT #N01-LM-6-3540

NLM Contract Phase I

- Baseline analysis using 1996 Providence Health Systems in Alaska "Lifeline" and IHS transportation records
- Technology assessment based on needs of "bush" and rural health care partners
- Identify 20 villages and 4 rural "hubs"
- Finalize equipment, technology and training

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Bristol Bay Health Corporation

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- Alaska Telemedicine Project
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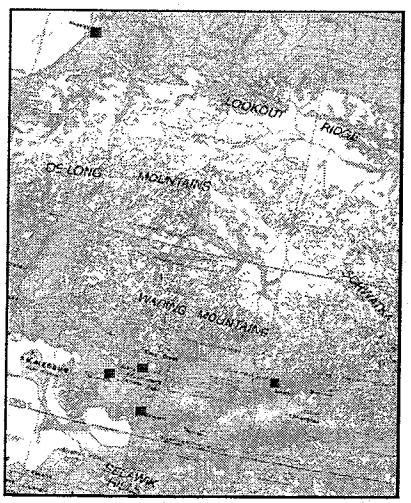

Manilaq Health Association

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ALASKA TELEMEDICINE TESTBED PROJECT

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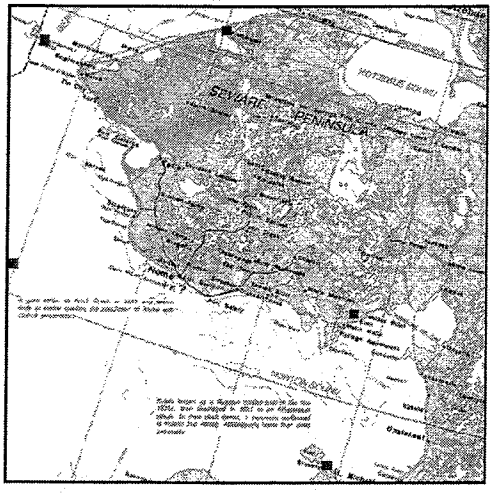

Norton Sound Health Corporation

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PTC Presentation

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ALASKA TELEMEDICINE TESTBED PROJECT

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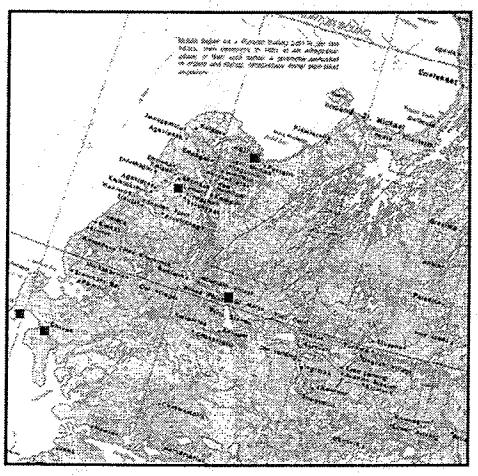

Yukon-Kuskokwim Health Corporation

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PTC Presentation

- Alaska Telecommunications
- Alaska Telemedicine Project
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ALASKA TELEMEDICINE TESTBED PROJECT

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NLM Contract Phase II

- Implementation of telemedicine technologies and applications that will take advantage of Alaska's "narrow bandwidth" telecommunications infrastructure
- E-mail and medical and health care informatics project designed to provide remote access to medical libraries at UAA and elsewhere to breakdown "professional isolation"

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Alaska Telecommunications

Alaska Telemedicine Project

NLM Contract Goals

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NLM Contract Evaluation

ALASKA TELEMEDICINE TESTBED PROJECT

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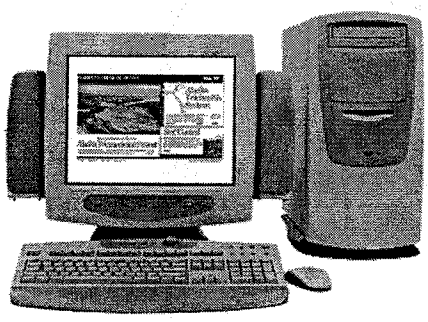
NLM Telemedicine Workstation



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Alaska Telecommunications

Alaska Telemedicine Project

NLM Contract Goals

NLM Contract Phase I

NLM Contract Phase II

NLM Contract Evaluation

NLM Contract Phase II

- Implementation and training of narrow bandwidth network-based telemedicine technologies and applications in 20 remote village clinics that do not now have telemedicine and telehealth capabilities
- Implementation of remote diagnostic and consultative telemedicine technologies including communication servers and digital scopes in four regional "hubs"
- Implementation of "narrow bandwidth" medical imaging technologies for ENT, radiology, orthopedic, and dermatology in village clinics

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Alaska Telecommunications

Alaska Telemedicine Project

NLM Contract Goals

NLM Contract Phase I

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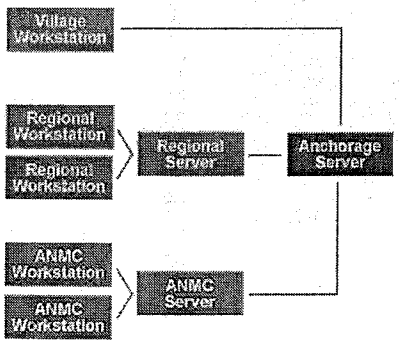
ALASKA TELEMEDICINE TESTBED PROJECT #N01-LM-6-3540

Anchorage Based Network Information Flow



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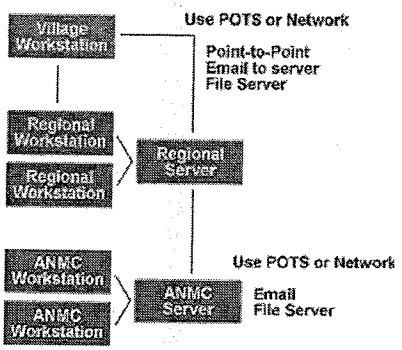
Regional Network Information Flow



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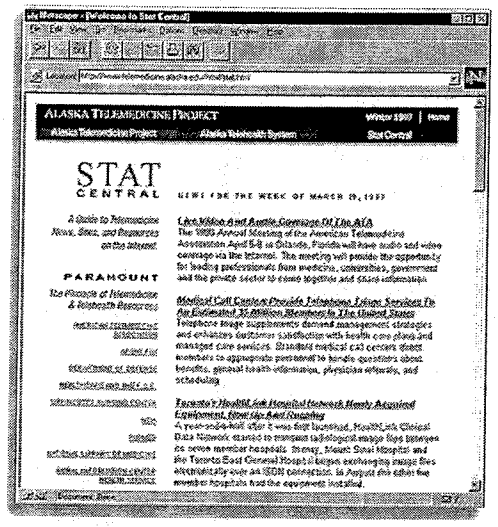

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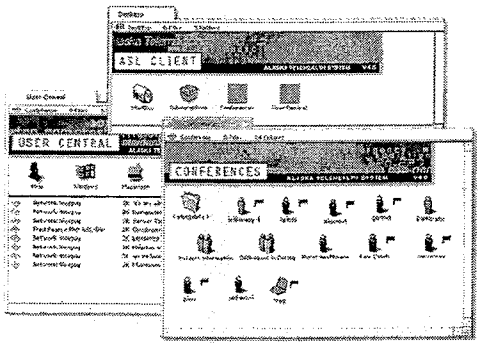

Alaska Telehealth System

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- Alaska Telecommunications
- Alaska Telemedicine Project
- NLM Contract Goals
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ALASKA TELEMEDICINE TESTBED PROJECT #N01-LM-6-3540

NLM Contract Evaluation Process

- Implementation of desktop Video Teleconferencing (VTC) for Anchorage-based consultants; "cross-funding" collaboration between IHS and private tertiary care hospitals based on current referral patterns
- Designed to look for costs and benefits; event and system satisfaction; and the increase or decrease in the length of stay in rural Alaska by health care providers

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- Alaska Telecommunications
- Alaska Telemedicine Project
- NLM Contract Goals
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- NLM Contract Evaluation

NLM Evaluation Process

- Cost and benefits model will focus on cost recovery from transportation and training budgets
- Satisfaction model will look at "as good or better than" current transportation-based model for clinical aids, consulting physicians, and patients
- "Survival" analysis will look at the cost of isolation and turnover among health care providers in Alaska

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Alaska Telecommunications

Alaska Telemedicine Project

NLM Contract Goals

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ALASKA TELEMEDICINE TESTBED PROJECT #N01-LM-6-3540

NLM Evaluation Process

- Evaluation will also compare villages and hubs to base-line data using a time series model
- Evaluation will compare villages and hubs before and after they receive telemedicine applications and technologies using an interrupted time series analysis with multiple baselines
- Uses a standardized communications protocol tailored to Alaska for evaluation "at-a-distance"

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Alaska Telecommunications

Alaska Telemedicine Project

NLM Contract Goals

NLM Contract Phase I

NLM Contract Phase II

NLM Contract Evaluation

The Alaska Telemedicine Project and its subset, the NLM contract:

- **"A partnership to use telecommunications and information technology to improve the delivery of health care to all Alaskans where and when it is needed."**

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Alaska Telemedicine Project

NLM Contract Goals

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ALASKA TELEMEDICINE PROJECT

Alaska Telehealth System

Kathe Boucha
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Providence Health System in Alaska

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kboucha@telemedicine.alaska.edu

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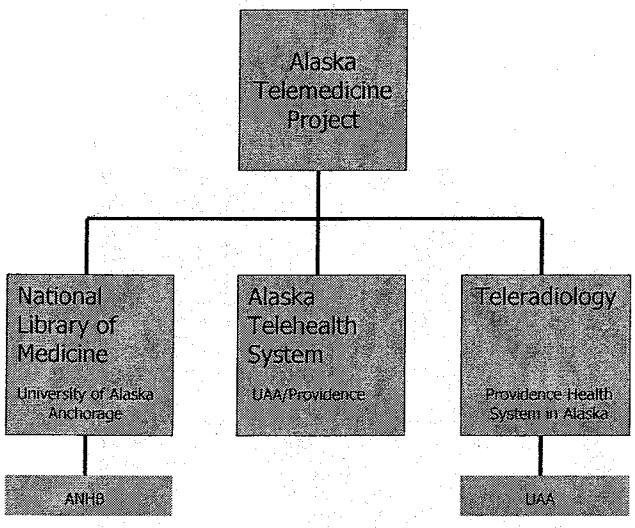

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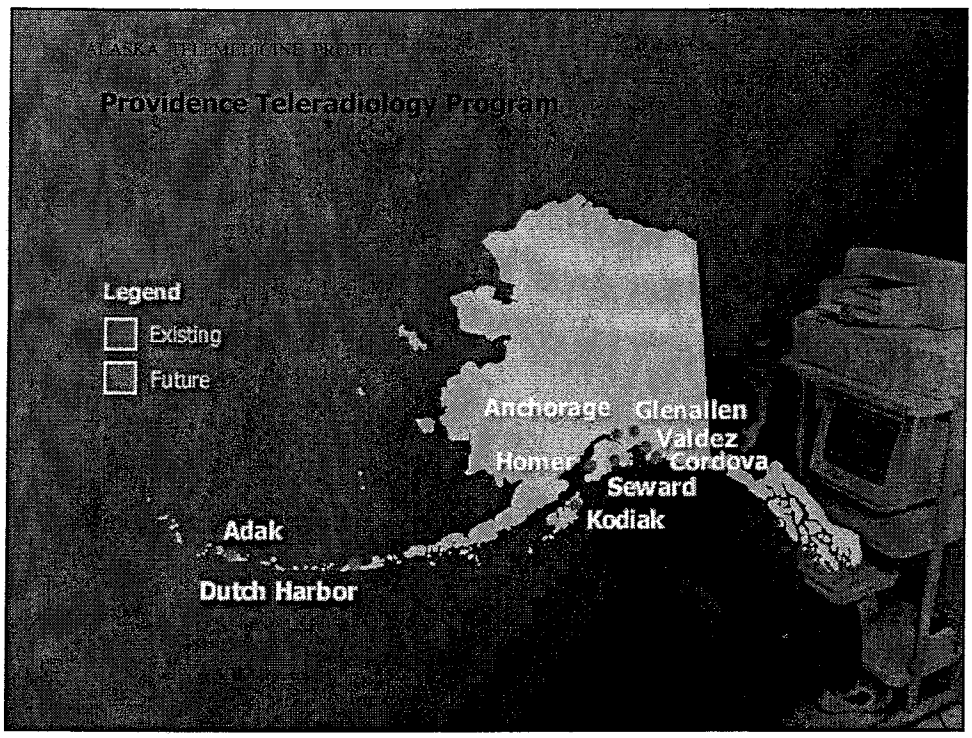
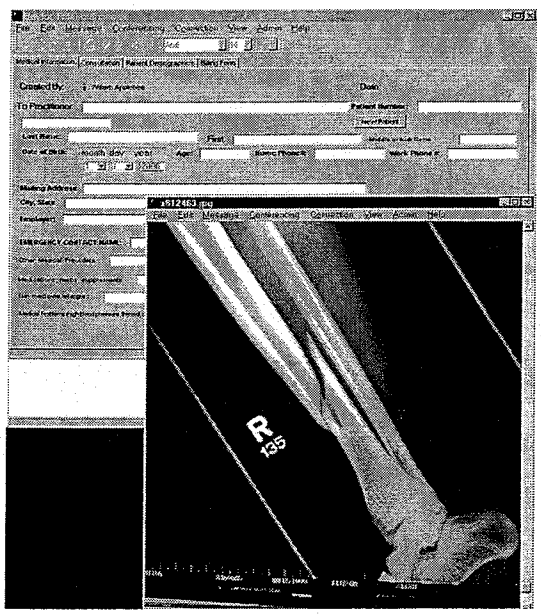


ALASKA TELEMEDICINE PROJECT



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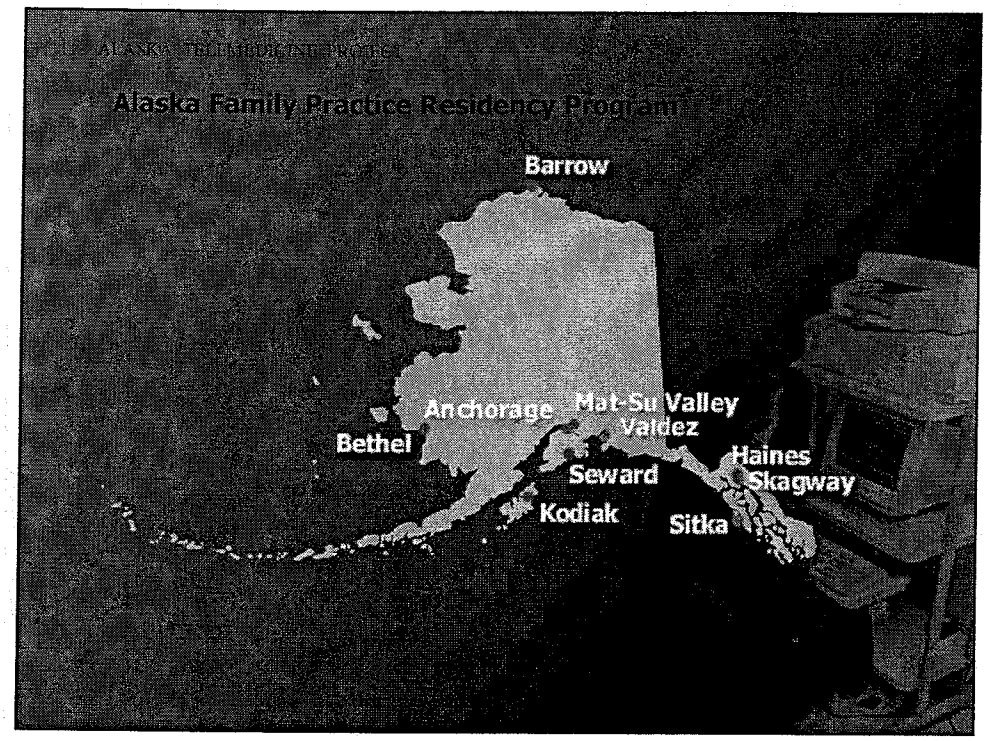
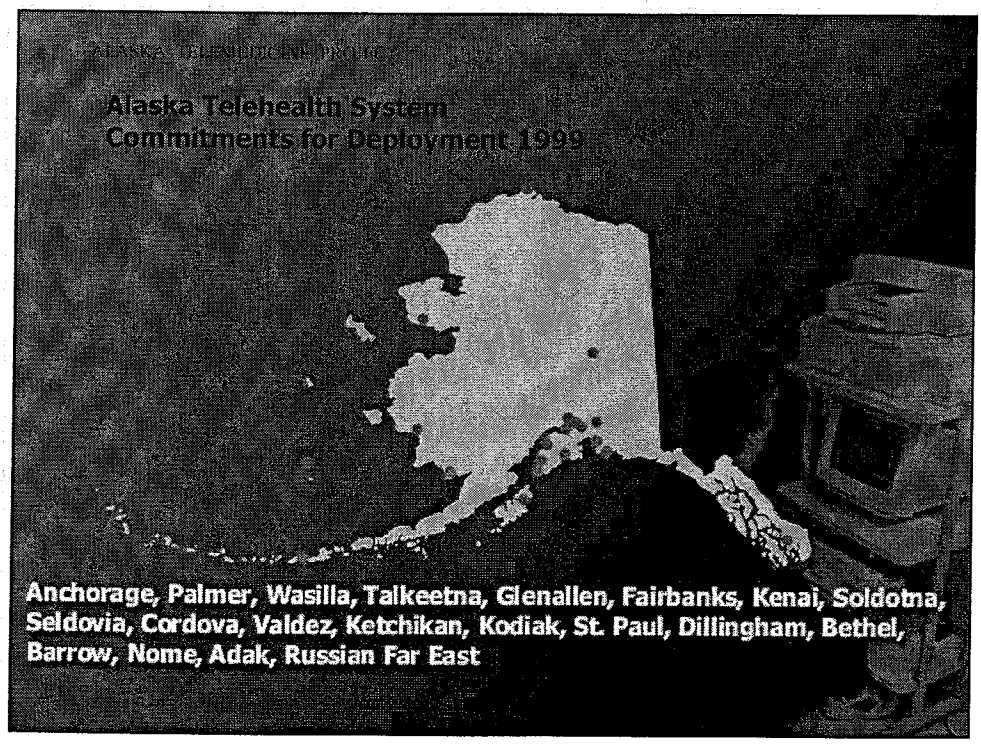

ALASKA TELEHEALTH PROJECT
Alaska Family Practice Residency Program
Barrow
Anchorage
Mat-Su Valley
Valdez
Bethel
Haines
Seward
Skagway
Kodiak
Sitka


ALASKA TELEHEALTH PROJECT
Alaska Telehealth System
Commitments for Deployment 1999
Anchorage, Palmer, Wasilla, Talkeetna, Glenallen, Fairbanks, Kenai, Soldotna, Seldovia, Cordova, Valdez, Ketchikan, Kodiak, St. Paul, Dillingham, Bethel, Barrow, Nome, Adak, Russian Far East

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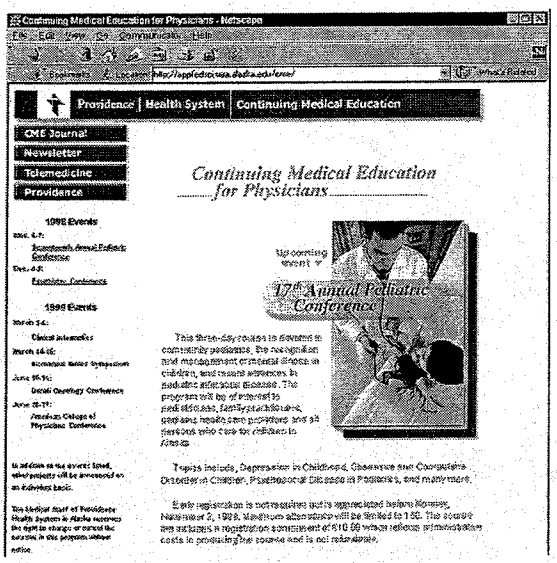

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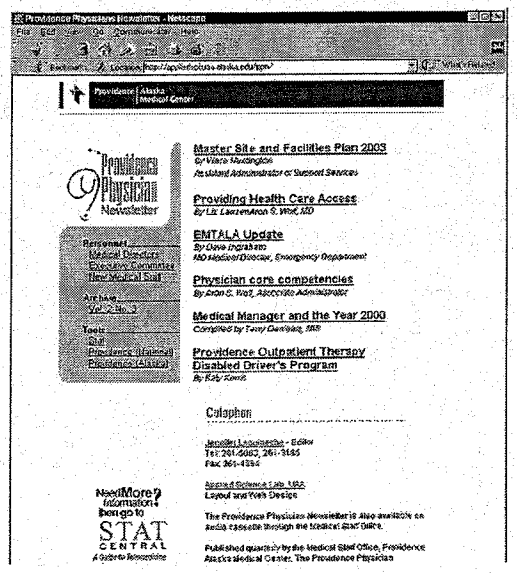

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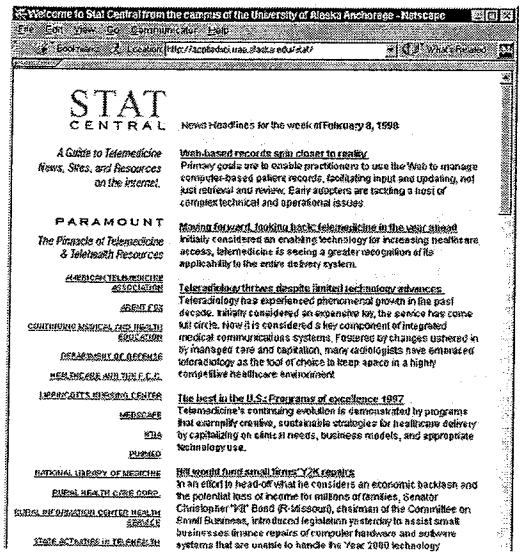

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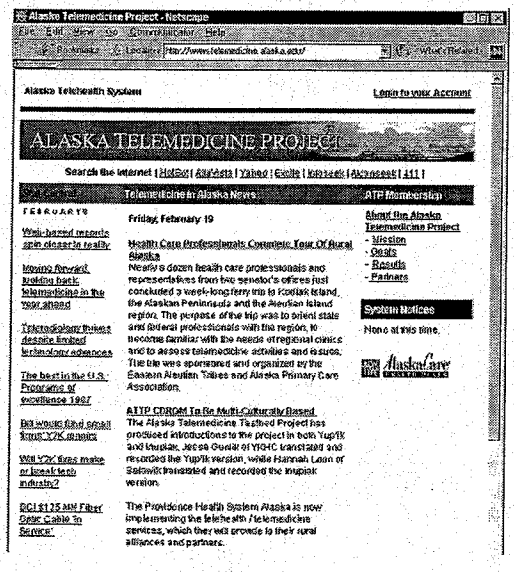

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ALASKA TELEMEDICINE PROJECT

Alaska Telehealth System

Debbi Kiley, RN, NP
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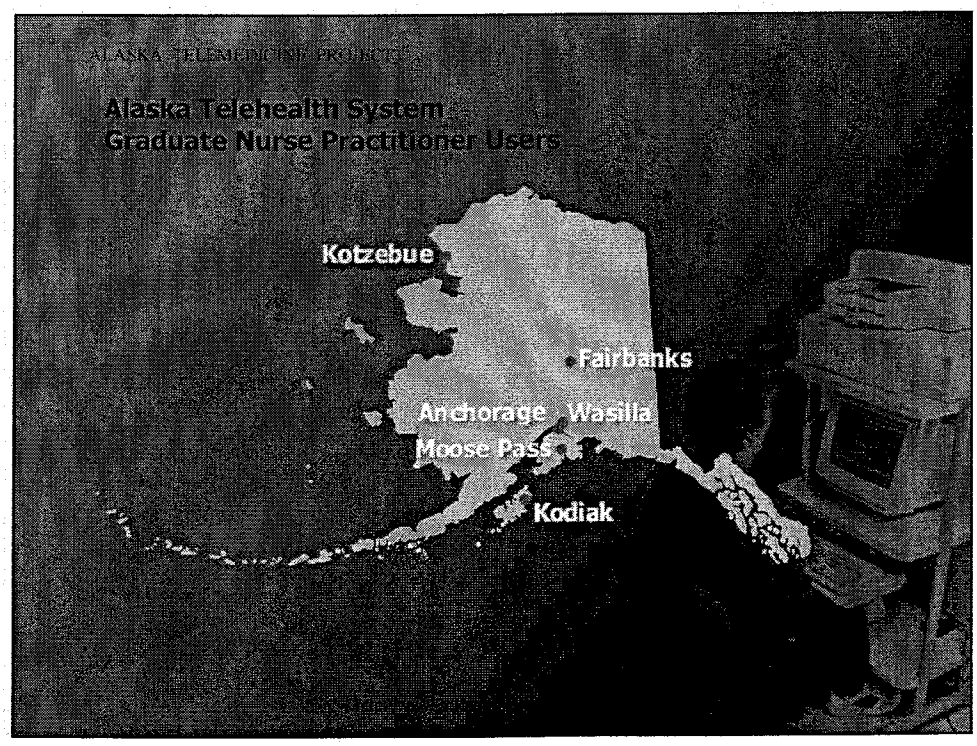

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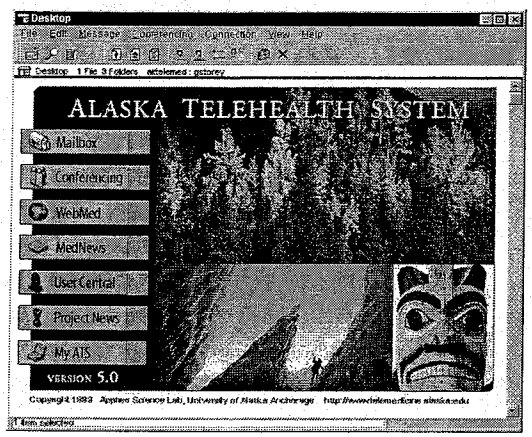
Alaska Telehealth System



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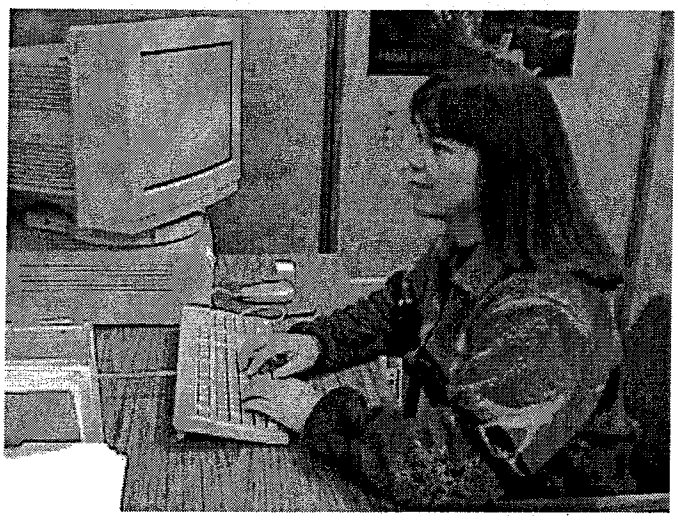

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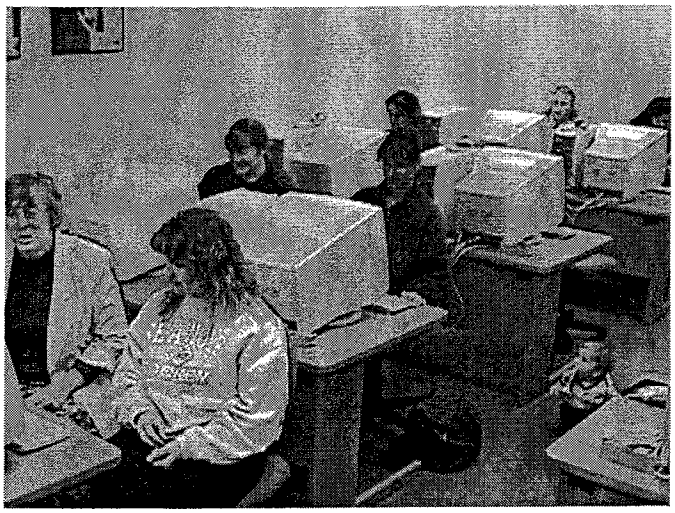

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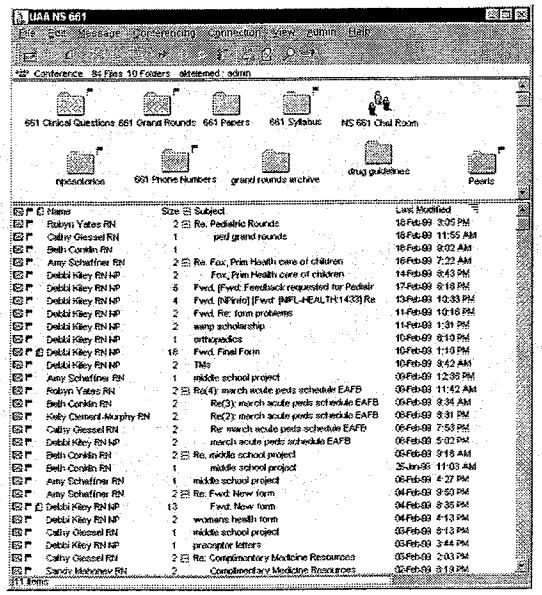

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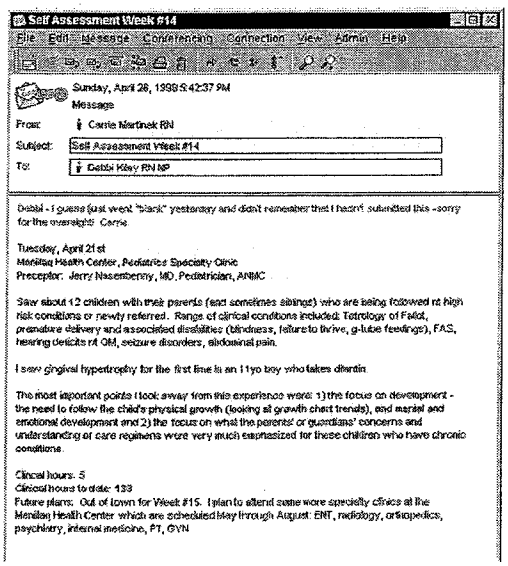
ALASKA TELEMEDICINE PROJECT



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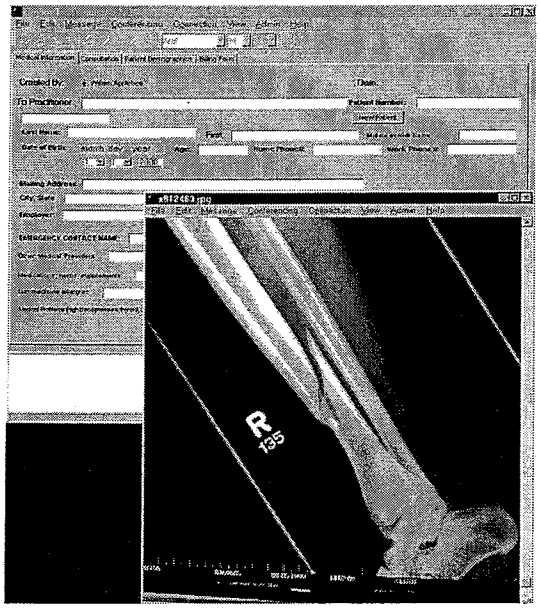

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ALASKA TELEMEDICINE PROJECT

Alaska Telehealth System

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10.151

Alaska Telemedicine Testbed Project

NLM Contract N01-LM-6-3540

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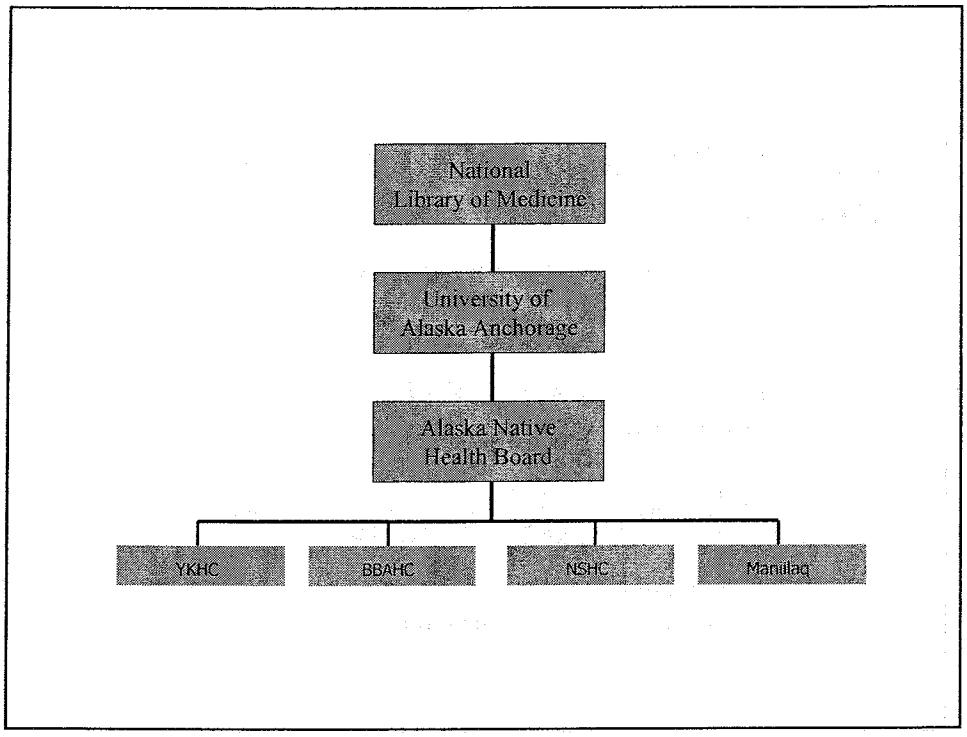
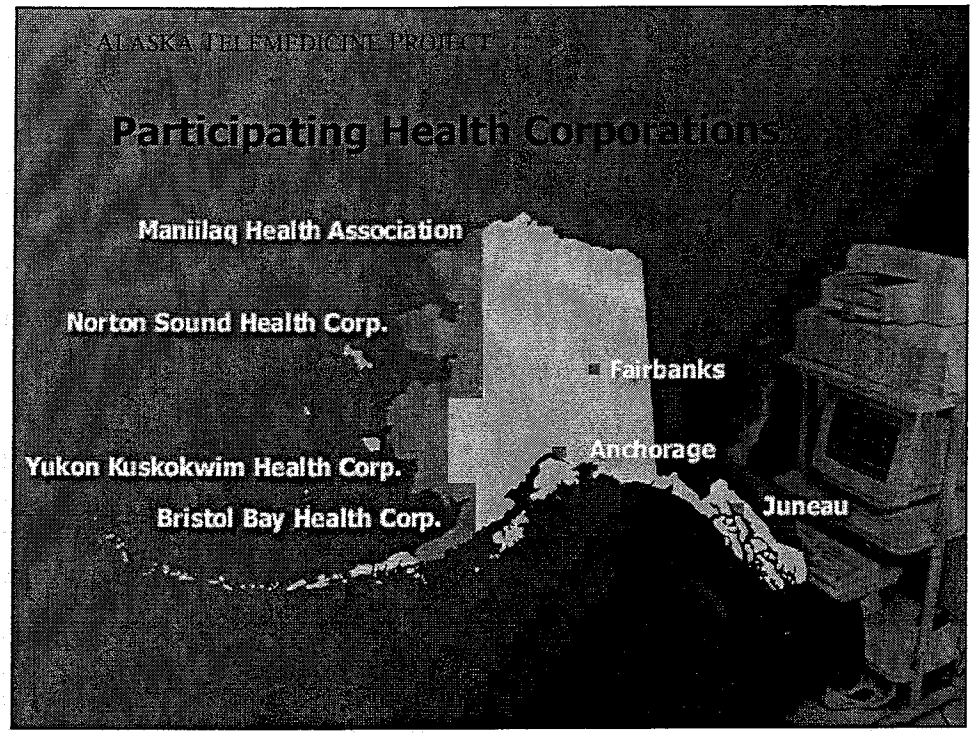
Frederick W. Pearce, Ph.D.	Principal Investigator, ATTP Project
Dennis G. Fisher, Ph.D.	Director, ATTP Evaluation
Andrea Fenaughty, Ph.D.	ATTP Quality Control
Askar Choudhury, Ph.D.	ATTP Satisfaction Study
Matt Berman, Ph.D.	ATTP Cost & Benefits Study
Denise Statz, PA-C	ANHB Project Manager
Destyne Taft	Training Materials Producer
Greg Storey	Presentation Designer

10.152



Basic Research Model

* Alaska data are being compared to 1996 transportation records for IHS and Providence Health Systems in Alaska; data mining revealed 90,000 air transports from rural Alaska to Anchorage in five clinics: emergency medicine; OBG/YN; dentistry, dermatology; ENT
* ENT was chosen as clinical focus of study because of the 4,500 transports for ENT; the statistical significance of ENT across the regions (no gender or age bias); and because of the severity of otitis media in rural Alaska
* The experimental design: time interrupted series model; villages and regions are compared to themselves in pre-and post-intervention model
* Data collection: survival data has been collected and processed; satisfaction data has been collected since Feb. 16, 1997 and continues; cost and benefit data has been requested from participating Alaska Native health corporations
* The methods of analysis: based on power calculations; SAS analysis.



Work Session December 1998

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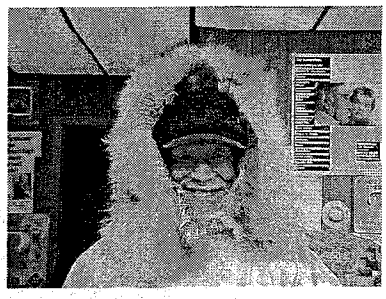
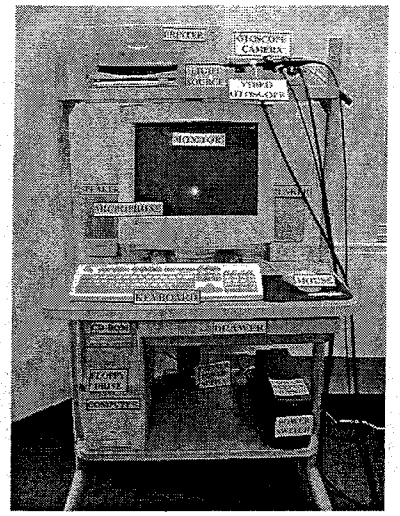
Deployment

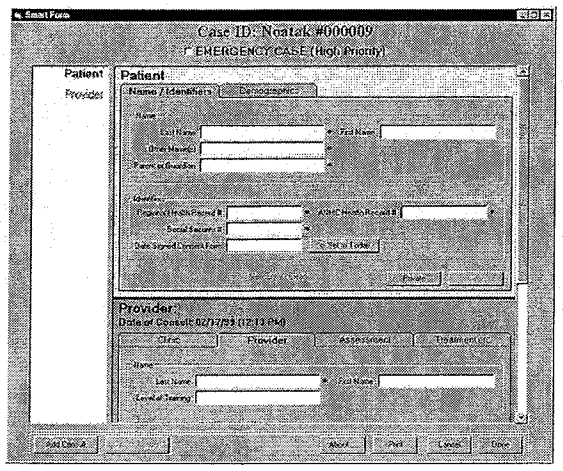


10.155

ATTP Workstation

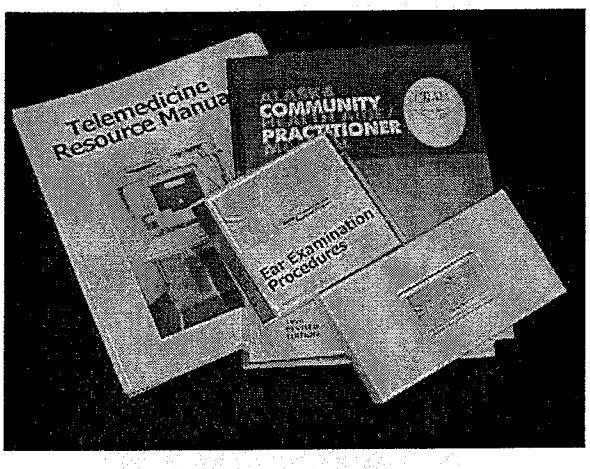


ATTP Software



10.156

Training Materials

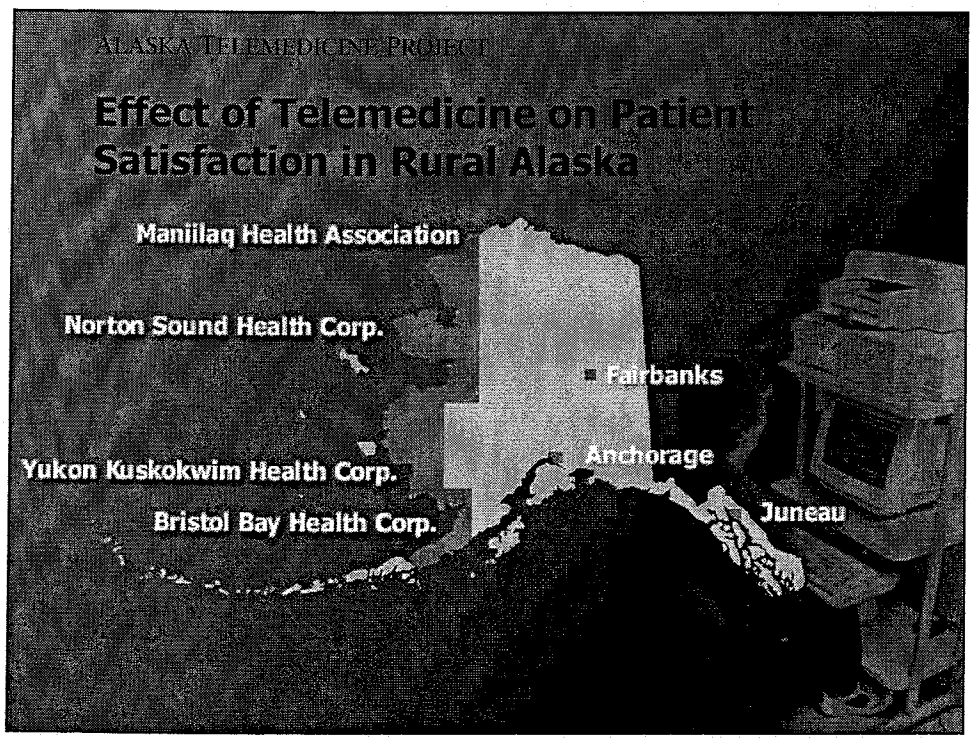


Training

10.157

ALASKA TELEMEDICINE PROJECT

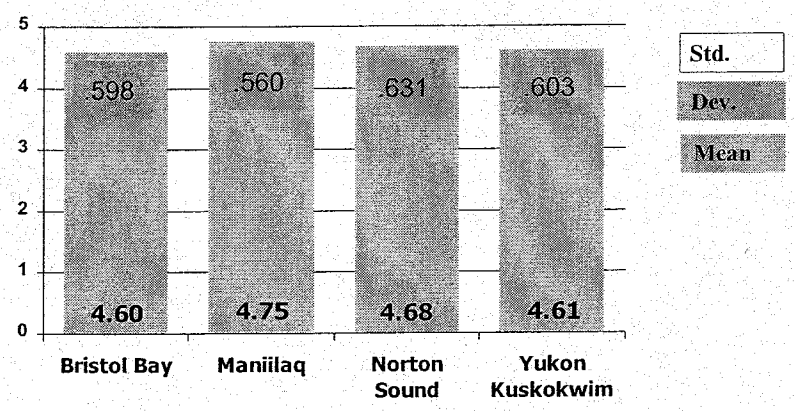
Effect of Telemedicine on Patient Satisfaction in Rural Alaska



Hypothesis

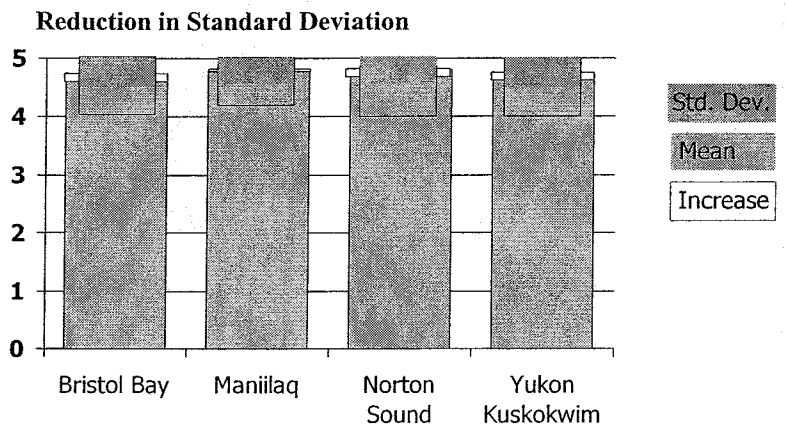
- Will effectively designed, deployed, and supported telemedicine and telehealth applications increase the effectiveness of healthcare delivery in rural Alaska and consequently increase the patients' overall "satisfaction" of healthcare?

Average Patient Satisfaction Level (Before Telemedicine)

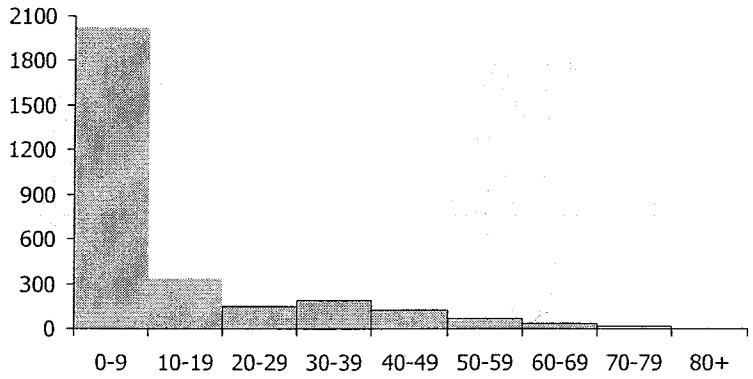


10.159

Patient Satisfaction (After Telemedicine)

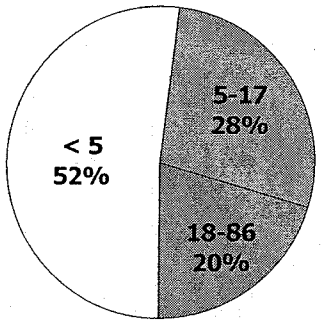


Age of Patient

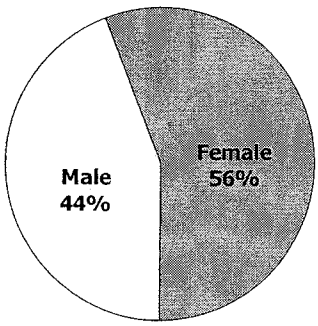


10.160

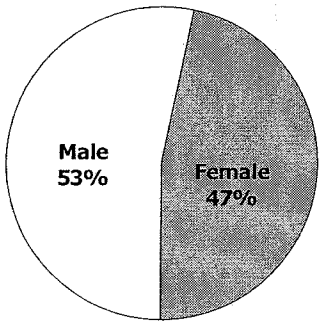
Age of Patient



Gender



by Patient
1998 Surveys



by Population
1990 Census

10.161

Overall Patient Satisfaction Model for Maniilaq Health Corporation

$$y = 0.14 + 0.15 sex + 0.28 Q_2 + 0.19 Q_3 + 0.40 Q_4 + -0.13\ Q_2\ sex$$

p-value = 0.00470.0405 <.0001 <.0001 <.0001 0.0047

Q_2 = I am satisfied with the amount of time the Provider spent with me

Q_3 = The Provider understood my needs and concerns

Q_4 = I am satisfied with the treatment provided for my health problem.

Hypothesis

- Will the implementation of effectively designed, deployed and supported telemedicine and telehealth applications significently increase the employment retention of healthcare providers in rural Alaska?

10.162

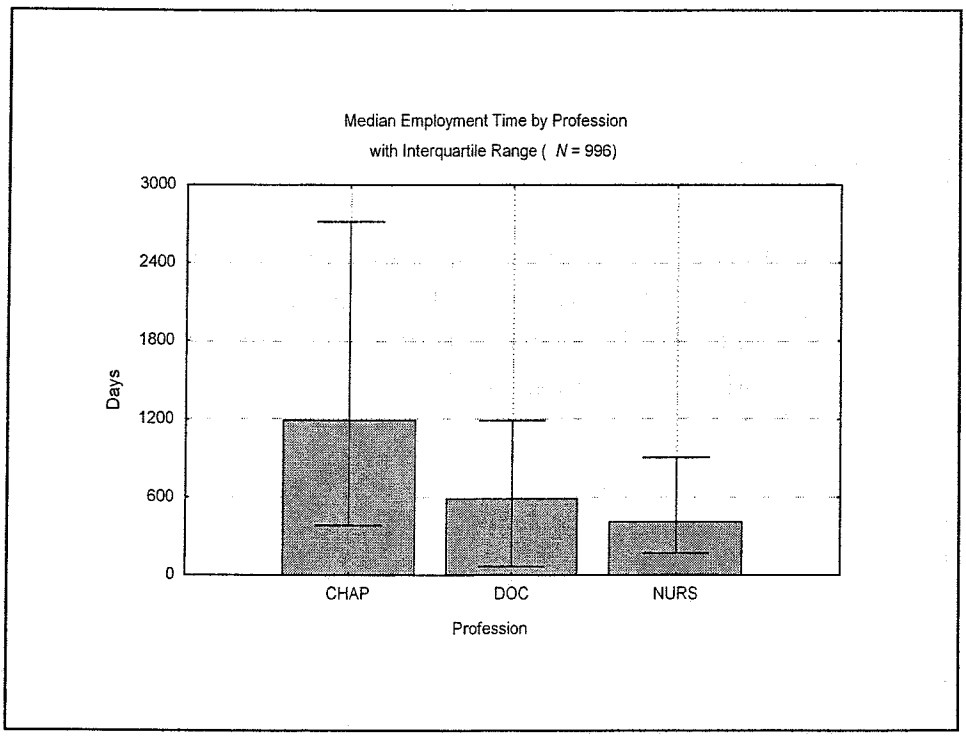
Methods

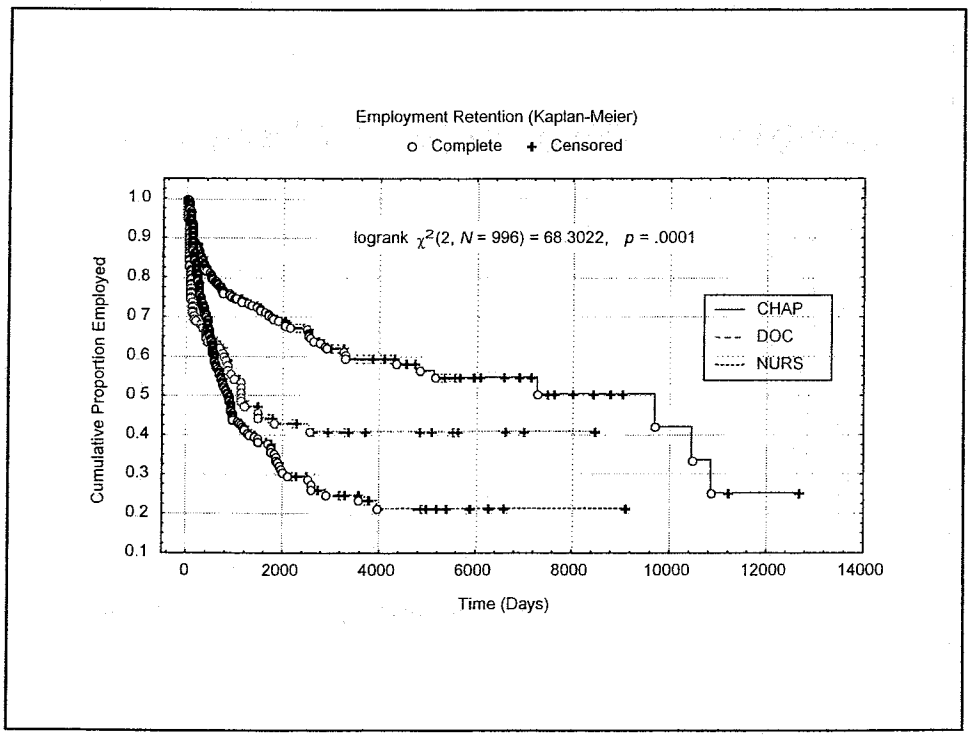
- Obtain data files from each region that includes: hire date, termination date, and position title for all doctors, nurses, and health aides.
- Compare Kaplan-Meier product limit survival curves of employment length before versus after telemedicine implementation.

Findings

- 57% of data points are censored (that is, employees had not been terminated by the time of data file construction).

10.163


Median Employment Time by Profession
with Interquartile Range (N = 996)
3000
2400
1800
1200
600
0
Days
CHAP
DOC
NURS
Profession

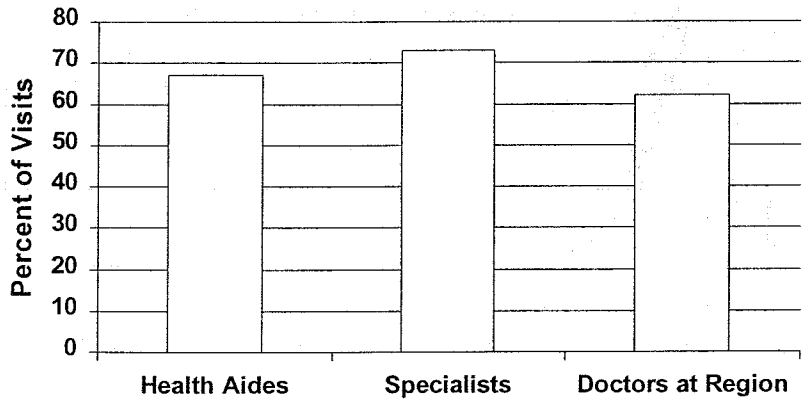

Employment Retention (Kaplan-Meier)
o Complete + Censored
logrank χ²(2, N = 996) = 68 3022, p = .0001
CHAP
DOC
NURS
Cumulative Proportion Employed
1 0
0.9
0.8
0 7
0.6
0 5
0.4
0.3
0.2
0.1
0
2000
4000
6000
8000
10000
12000
14000
Time (Days)

10.164

Hypothesis

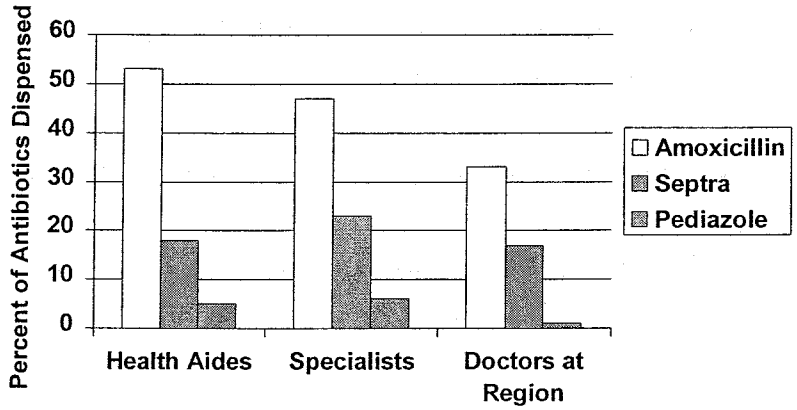
- Will the implementation of effectively designed, deployed and supported telemedicine and telehealth applications significently affect the antibiotic use in rural Alaska?

Antibiotics Dispensed, by Provider

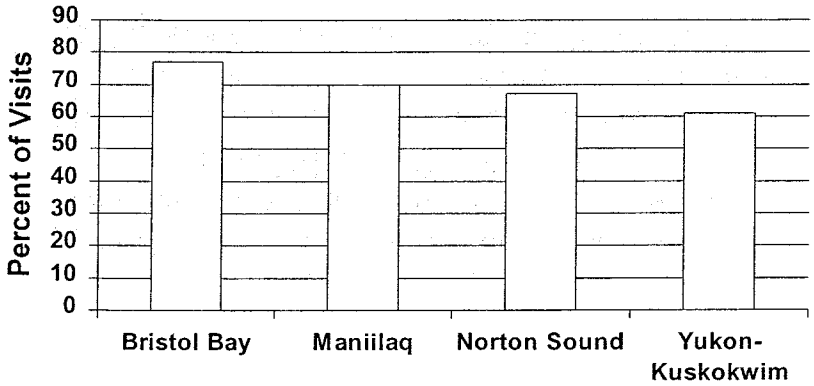


10.165

Top 3 Antibiotics Dispensed, by Provider



Antibiotics Dispensed, by Region (Health Aides only)



χ^2 (3, n = 2908) = 29.7, p < .001

10.166

Future Analyses

- Test for changes in % of visits that result in prescription of antibiotics
- Test for changes in kinds of antibiotics dispensed
  - Examine regional, provider differences

Hypothesis

- Will the implementation of effectively designed, deployed and supported telemedicine and telehealth applications be cost effective given rural Alaska's great distances, low population density, "third world" telecommunications infrastructure, and current "transportation-based" system of healthcare delivery?

10.167

Cost Effectiveness Analysis

- Cost assumptions:
  - "sustainability" is the ability for the Native Health Corporation to pay for the healthcare service
  - in rural Alaska you can't "make up the difference in volume"
- Cost Effectiveness Analysis assumptions
  - health care service must be "as good of better" than current service based on transportation
  - ENT and dermatology services may be cost justified against transportation costs
  - cost effectiveness must be viewed in terms of the "cost per transaction"

Findings and Discussion

- More than 1,600 ENT clinical events logged
- ATTP system designed for ENT; used for ENT, Dermatology, EMT
- Patients' and Providers' "satisfaction" related to training and support
- Provider "survival" data suggests that telemedicine and telehealth applications do not increase the length of stay of healthcare providers in rural Alaska

Benefits Analysis

- Rural health providers have looked to telemedicine as a technology to reduce costs.
- However, virtual access to physicians and specialists may alter patients' demand for
- face-to-face physician access. We develop a model of service demand under managed
- care, and apply the model to a telemedicine application in rural Alaska. Provider-imposed
- delays and patient costs were highly significant predictors of patient contingent
- choices in a survey of ENT clinic patients. The results suggest that telemedicine
- reduced the mean patient loss from rationing of physician access by 46 percent, or

Benefits Analysis

- we
- estimate that a telemedicine innovation increased estimated patient benefits by about 20
- percent, and reduced the estimated loss from rationing of access to physicians by 46
- percent.

Benefits Analysis

- The value of travel to see a physician, if patients were given the choice, averages
- $65 without telemedicine, declining to $54 with telemedicine. In this rural Alaska
- managed care case, the technological innovation increases the value of the provided
- service and reduces the value of the rationed service. Considering alternatives 1 and 2
- combined, introduction of telemedicine reduces the patient's average loss from service
- rationing from $54 to $29 per visit.

Benefits Analysis

- **Table 4. Estimated Compensating Variation for Rural Alaska Health Services:**
- **With and Without Telemedicine**
- (Evaluated for period with telemedicine implemented: 497 observations)
- Alternative
- Without
- telemedicine:
- q 1 = q 1 0
- With
- telemedicine:
- q 1 = q 1 1 Difference
- CHP clinic (alternative 1)
- unrestricted: S * $399.00 $495.30 $96.30
- ~~physician access rationed: S r 410.20 520.20 110.00~~

10.170

Benefits Analysis

- Rural health providers have looked to telemedicine as a technology to reduce costs.
- However, virtual access to physicians and specialists may alter patients' demand for
- face-to-face physician access. We develop a model of service demand under managed
- care, and apply the model to a telemedicine application in rural Alaska. Provider-imposed
- delays and patient costs were highly significant predictors of patient contingent
- choices in a survey of ENT clinic patients. The results suggest that telemedicine
- reduced the mean patient loss from rationing of physician access by 46 percent, or

Findings and Discussion

- Cost Effectiveness analysis needs to be conducted with data from all four Alaska Native Health Corporations one year and three years after implementation
- The Alaska Telemedicine Testbed Project has received a one-year continuation of funding from the National Library of Medicine to complete Cost Effectiveness analysis

Telemedicine and Antibiotic Dispensation

Telemedicine and Antibiotic Dispensation

Antimicrobial overprescription contributes to bacterial resistance

The diagnosis of otitis media accounts for a large proportion of antibiotic prescription, particularly among young children

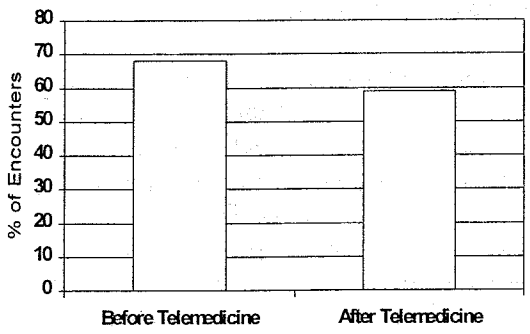
Consultation with ENT specialists via telemedicine equipment may result in more judicious dispensation of antibiotics by village health aides

10.172

Research Question:

Is the *existence of* telemedicine equipment in the village clinics associated with antibiotic dispensation by village health aides?

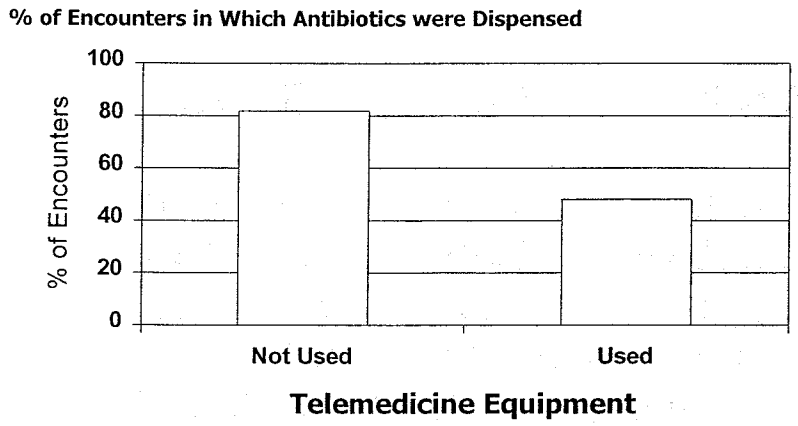
% of Encounters in Which Antibiotics were Dispensed



$\chi^2(1, \underline{n} = 4039) = 20.34, \underline{p} < .001$

10.173

- Research Question:
  - After implementation of telemedicine equipment, is there an association between *use* of the equipment and antibiotic dispensation by village health aides?



$\chi^2(1, \underline{n} = 507) = 60.44, \underline{p} < .001$

10:174

- Research Question:
  - Does the association between use of telemedicine and antibiotic dispensation hold after controlling for potential confounders?
    - –Severity of the case
    - –Age of the patient

ession Model Predicting Dispensation of Antibiotics by

Variable	OR	LCL UCL
Gender	1.30	0.87, 1.98
Age (5 yrs)	0.99	0.89, 0.99
Orders	2.12	1.34, 3.35
Sent to Region	0.28	0.11, 0.70
No Telemed	**6.22**	**3.92, 9.87**

$\chi^2(8) = 9.31$, $p = .32$

10.175

Conclusions

- Deployment and use of ENT-related telemedicine equipment is associated with a decrease in the dispensation of antibiotics by village health aides, even when controlling for potential confounders.

Preliminary Conclusions

- Rural health care providers, especially the Community Health Aides, "love" the ATTP system and "don't know how they were able to do their jobs before the telemedicine system"
- As the result of the Alaska Telemmedicine Testbed Project, Alaska's Congressional delegation has designated funding through IHS, VA, DOD, and DOT appropriations to deploy the ATTP system to all 235 villages and communities in rural Alaska

Alaska Telemedicine Testbed Project

NLM Contract N01-LM-6-3540

Frederick W. Pearce, Ph.D.
Principal Investigator

Director, Applied Science Lab
University of Alaska Anchorage

907-786-4183
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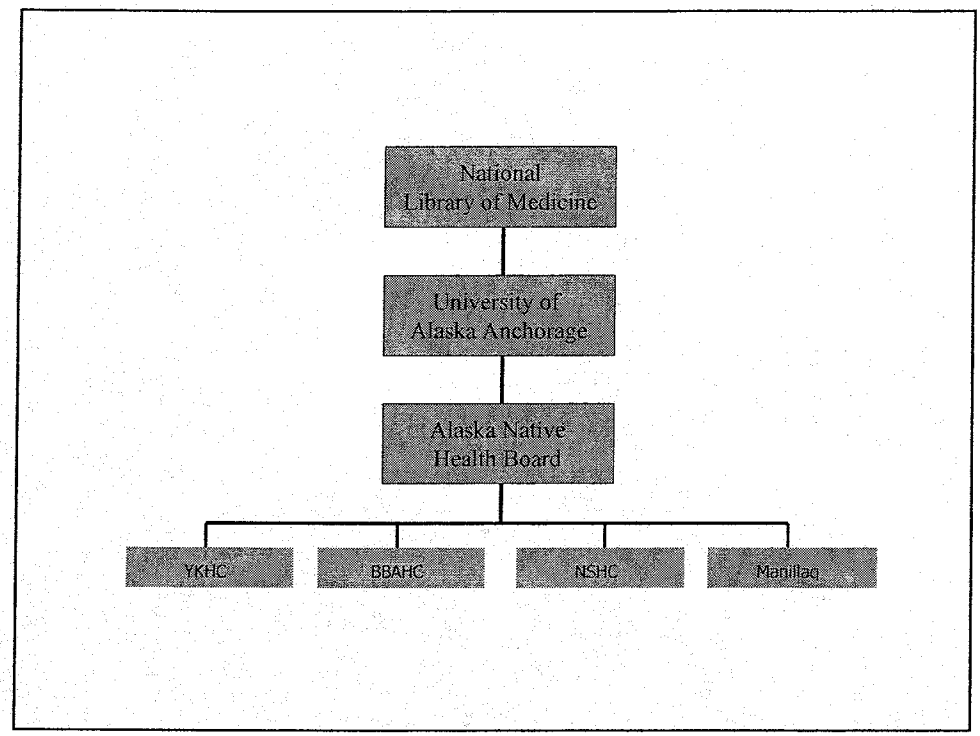
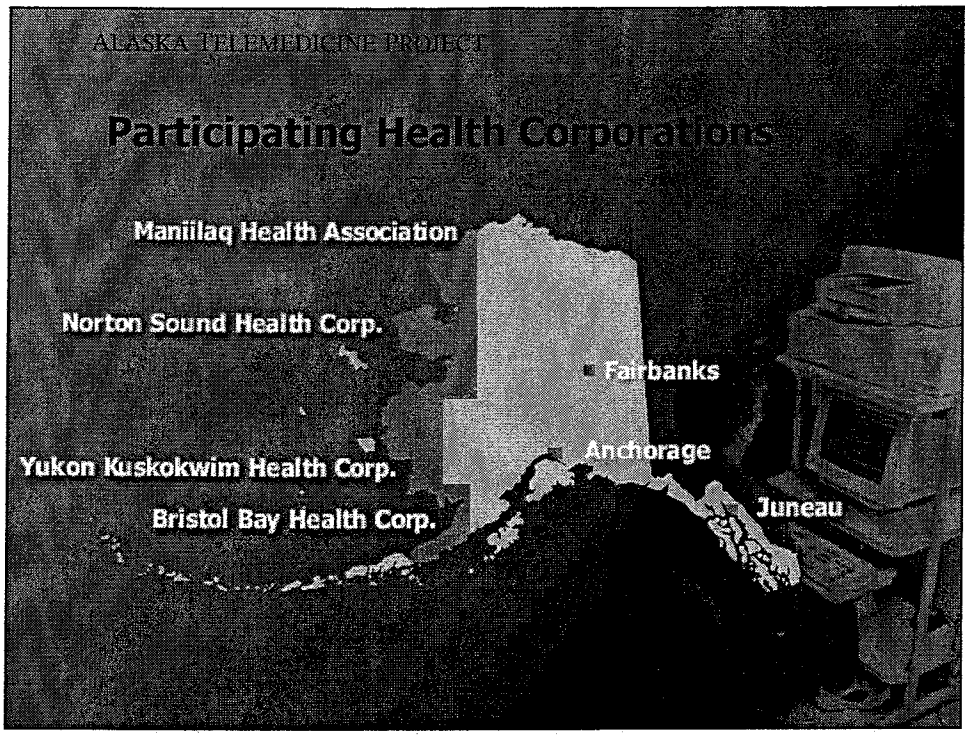
Frederick W. Pearce, Ph.D.	Principal Investigator, ATTP Project
Dennis G. Fisher, Ph.D.	Director, ATTP Evaluation
Andrea Fenaughty, Ph.D.	ATTP Quality Control
Askar Choudhury, Ph.D.	ATTP Satisfaction Study
Matt Berman, Ph.D.	ATTP Cost & Benefits Study
Denise Statz, PA-C	ANHB Project Manager
Destyne Taft	Training Materials Producer
Greg Storey	Presentation Designer

10.177



Basic Research Model

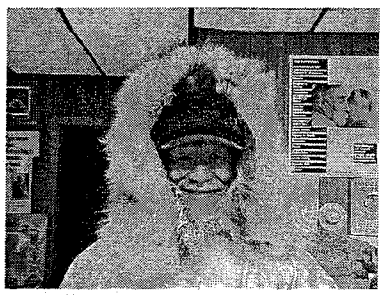
* Alaska data are being compared to 1996 transportation records for IHS and Providence Health Systems in Alaska; data mining revealed 90,000 air transports from rural Alaska to Anchorage in five clinics: emergency medicine; OBG/YN; dentistry, dermatology; ENT
* ENT was chosen as clinical focus of study because of the 4,500 transports for ENT; the statistical significance of ENT across the regions (no gender or age bias); and because of the severity of otitis media in rural Alaska
* The experimental design: time interrupted series model; villages and regions are compared to themselves in pre-and post-intervention model
* Data collection: survival data has been collected and processed; satisfaction data has been collected since Feb. 16, 1997 and continues; cost and benefit data has been requested from participating Alaska Native health corporations
* The methods of analysis: based on power calculations; SAS analysis.



Work Session December 1998

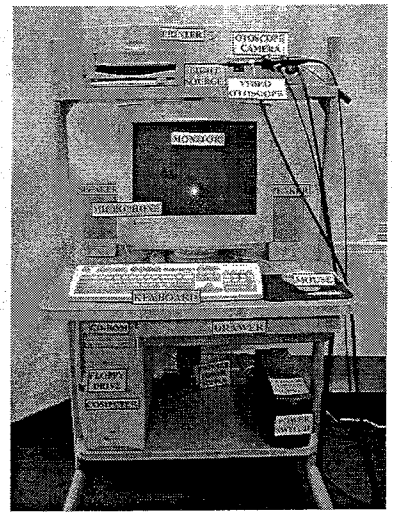
10.179

Deployment

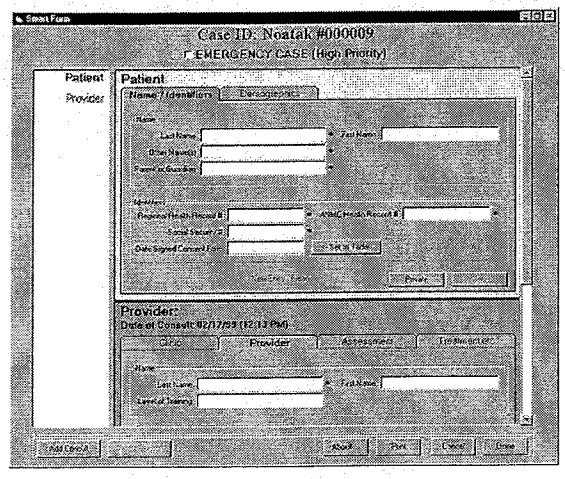


10.186

ATTP Workstation



ATTP Software

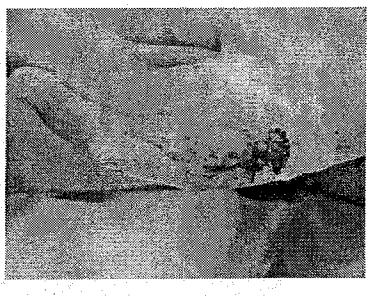


10.181

Training Materials

Training

10.182



ALASKA TELEMEDICINE PROJECT

Effect of Telemedicine on Patient Satisfaction in Rural Alaska

Maniilaq Health Association

Norton Sound Health Corp.

Fairbanks

Anchorage

Yukon Kuskokwim Health Corp.

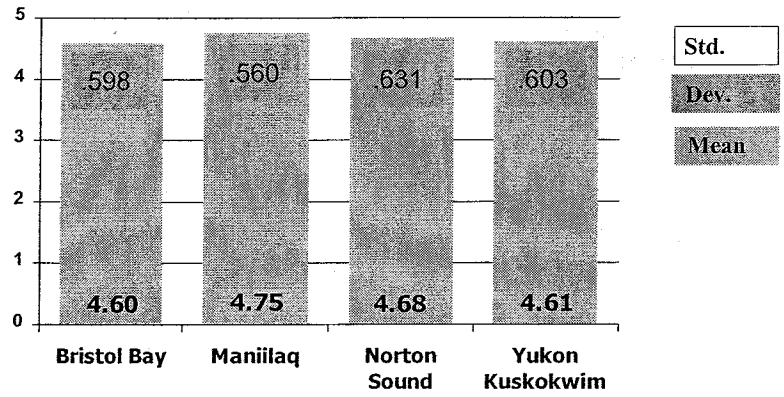
Bristol Bay Health Corp.

Juneau

Hypothesis

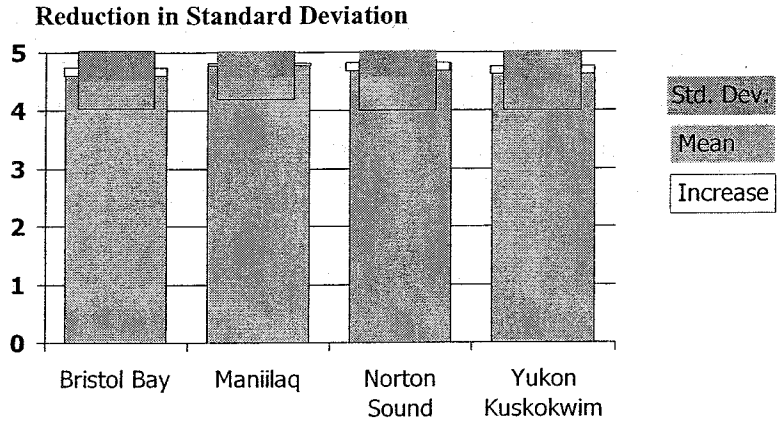
- Will effectively designed, deployed, and supported telemedicine and telehealth applications increase the effectiveness of healthcare delivery in rural Alaska and consequently increase the patients' overall "satisfaction" of healthcare?

Average Patient Satisfaction Level (Before Telemedicine)

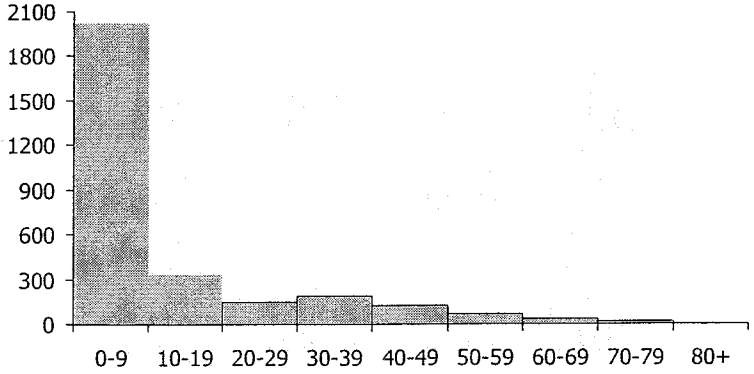


10.184

Patient Satisfaction (After Telemedicine)

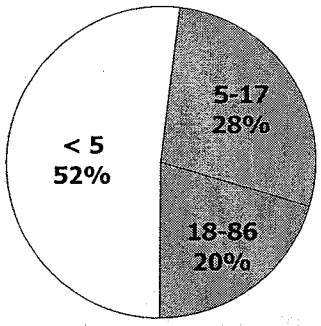


Age of Patient

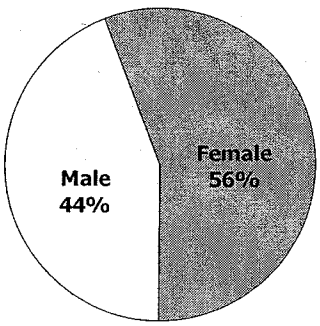


10.185

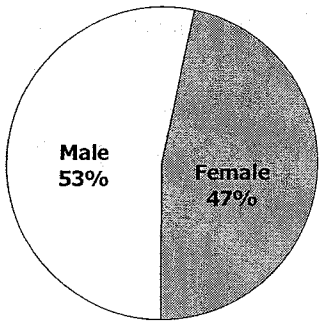
Age of Patient



Gender



by Patient
1998 Surveys



by Population
1990 Census

10.186

Overall Patient Satisfaction Model for Maniilaq Health Corporation

$$y = 0.14 + 0.15sex + 0.28Q_2 + 0.19Q_3 + 0.40Q_4 + -0.13\ Q_2\ sex$$

p-value = 0.0047 0.0405 <.0001 <.0001 <.0001 0.0047

Q_2 = I am satisfied with the amount of time the Provider spent with me

Q_3 = The Provider understood my needs and concerns

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Hypothesis

- Will the implementation of effectively designed, deployed and supported telemedicine and telehealth applications significently increase the employment retention of healthcare providers in rural Alaska?

10.187

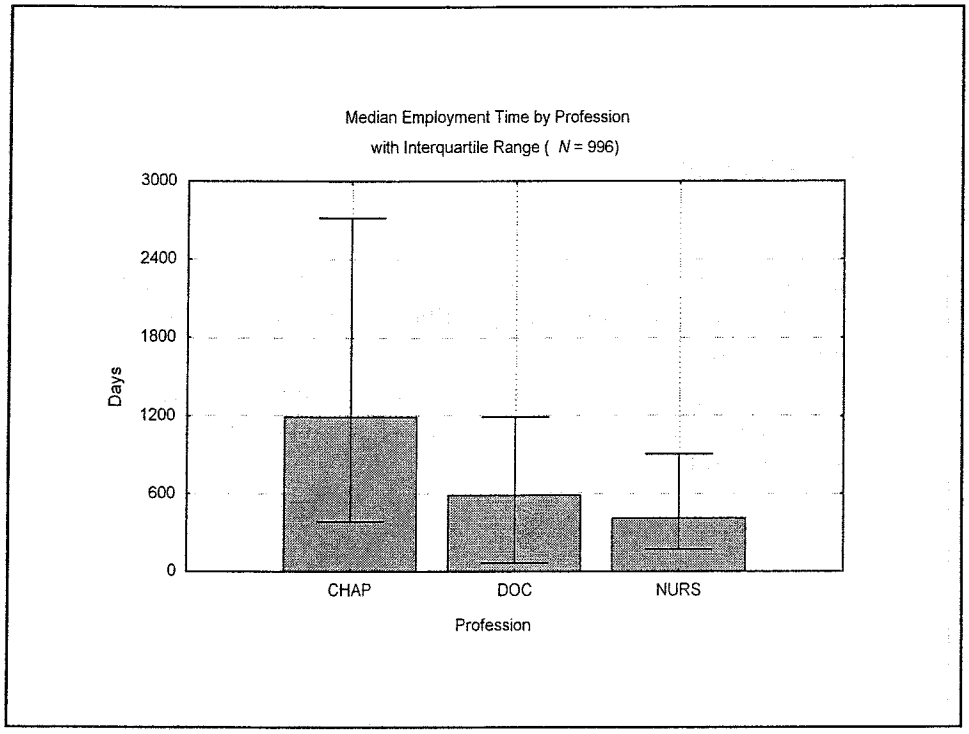
Methods

- Obtain data files from each region that includes: hire date, termination date, and position title for all doctors, nurses, and health aides.
- Compare Kaplan-Meier product limit survival curves of employment length before versus after telemedicine implementation.

Findings

- 57% of data points are censored (that is, employees had not been terminated by the time of data file construction).

10.188


Median Employment Time by Profession
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3000
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Days
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DOC
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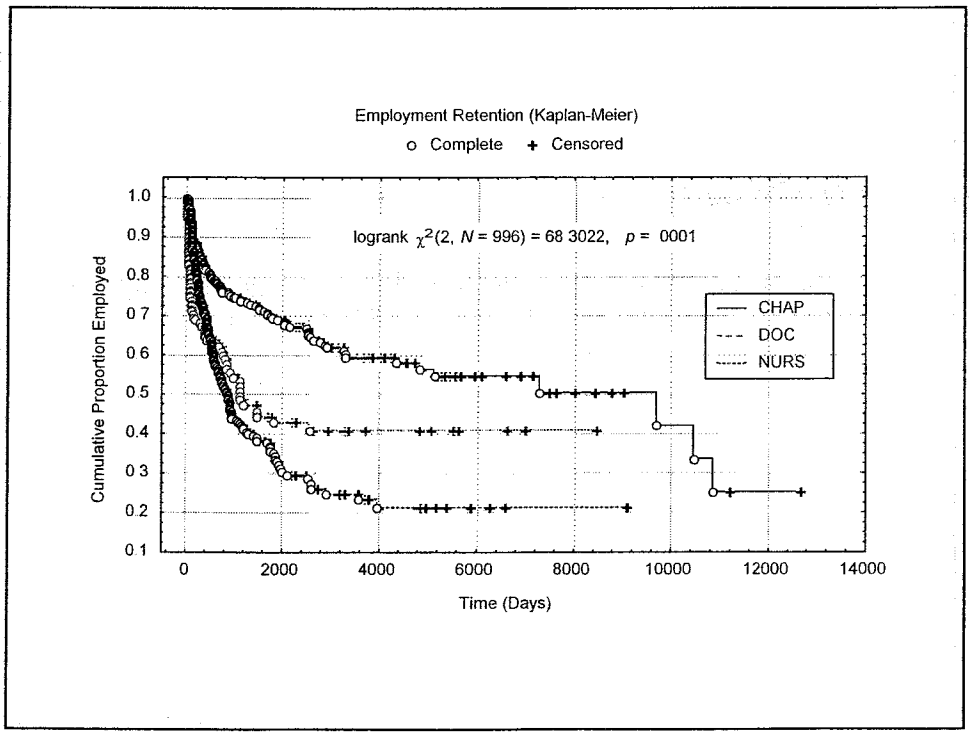
Profession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CHAP
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Cumulative Proportion Employed
1.0
0.9
0.8
0 7
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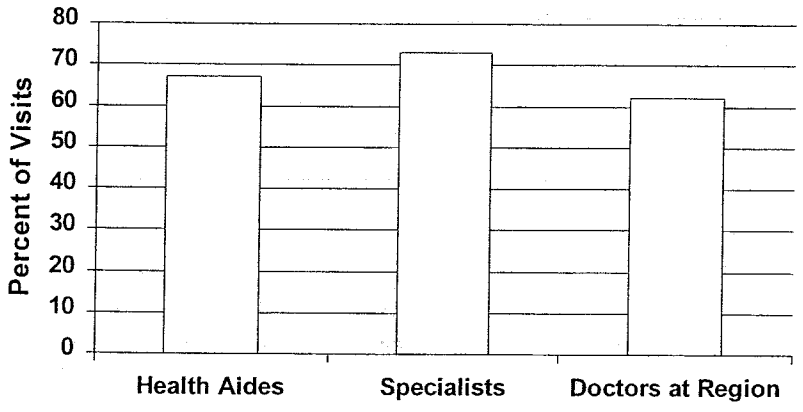
0.5
0.4
0 3
0.2
0.1
0
2000
4000
6000
8000
10000
12000
14000
Time (Days)

10.189

Hypothesis

- Will the implementation of effectively designed, deployed and supported telemedicine and telehealth applications significently affect the antibiotic use in rural Alaska?

Antibiotics Dispensed, by Provider



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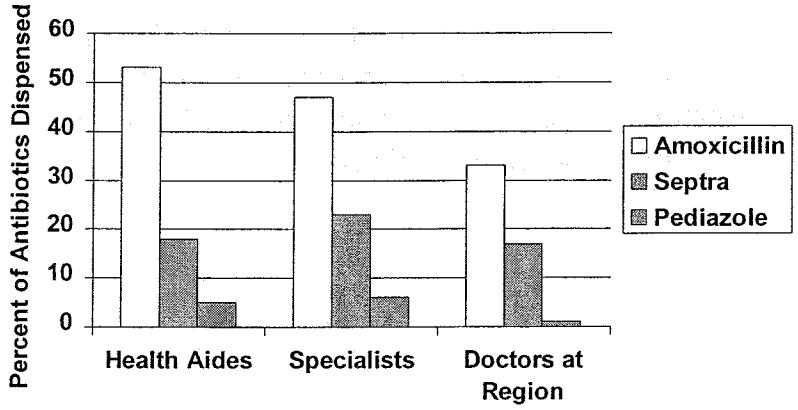
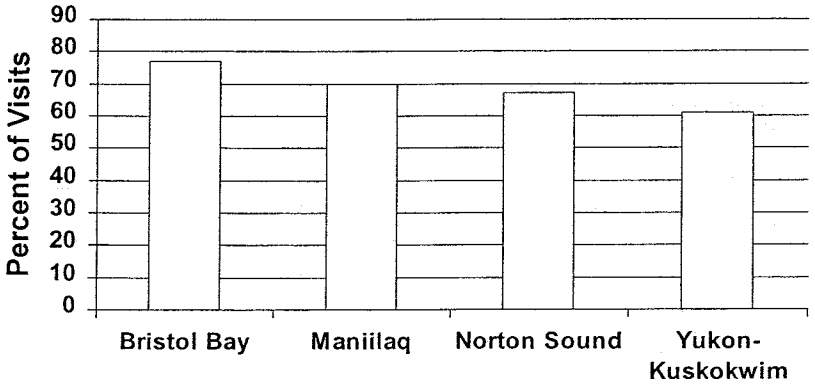
Top 3 Antibiotics Dispensed, by Provider



Antibiotics Dispensed, by Region (Health Aides only)



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10.191

Future Analyses

- Test for changes in % of visits that result in prescription of antibiotics
- Test for changes in kinds of antibiotics dispensed
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10.192

Cost Effectiveness Analysis

- Cost assumptions:
  - "sustainability" is the ability for the Native Health Corporation to pay for the healthcare service
  - in rural Alaska you can't "make up the difference in volume"
- Cost Effectiveness Analysis assumptions
  - health care service must be "as good of better" than current service based on transportation
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  - cost effectiveness must be viewed in terms of the "cost per transaction"

Findings and Discussion

- More than 1,600 ENT clinical events logged
- ATTP system designed for ENT; used for ENT, Dermatology, EMT
- Patients' and Providers' "satisfaction" related to training and support
- Provider "survival" data suggests that telemedicine and telehealth applications do not increase the length of stay of healthcare providers in rural Alaska

10,193

Findings and Discussion

- Cost Effectiveness analysis needs to be conducted with data from all four Alaska Native Health Corporations one year and three years after implementation
- The Alaska Telemedicine Testbed Project has received a one-year continuation of funding from the National Library of Medicine to complete Cost Effectiveness analysis

Preliminary Conclusions

- Rural health care providers, especially the Community Health Aides, "love" the ATTP system and "don't know how they were able to do their jobs before the telemedicine system"
- As the result of the Alaska Telemmedicine Testbed Project, Alaska's Congressional delegation has designated funding through IHS, VA, DOD, and DOT appropriations to deploy the ATTP system to all 235 villages and communities in rural Alaska

NLM Reverse Site Visit Presentation

Alaska Telemedicine Testbed Project

NLM Contract N01-LM-6-3540

Fred Pearce, Ph. D.
Director, Applied Science Lab
University of Alaska Anchorage

What aspects of telemedicine are you evaluating?

We are evaluating the use of narrow bandwidth telemedicine in 30 sites in frontier, western Alaska. We are learning how to develop and deploy telemedicine systems in frontier Alaska.

We are evaluating the following:

10.195

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- Can telemedicine work in Alaska given the vast distances and telecommunications infrastructure with a maximum throughput of 6 kbps from villages?

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10.198

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- Will the uses of advanced telecommunications and information technology for health care informatics increase the length of stay on the job by health care professionals in rural Alaska?
- What are the costs and benefits of telemedicine (when compared to a transportation-based model of healthcare delivery) in rural Alaska?
- Is store and forward telemedicine appropriate for ENT in rural Alaska?

How are you accomplishing this evaluation, eg. Nature of the experimental design, data collection, methods of analysis?

We are using a time interrupted series model of analysis for patient and provider satisfaction with the current method of health care delivery compared across time with telemediated ENT

How are you accomplishing this evaluation, eg. Nature of the experimental design, data collection, methods of analysis?

- Alaska data is being compared to 1996 transportation records for IHS and Providence Health Systems in Alaska; data mining revealed 90,000 air transports from rural Alaska to Anchorage in five clinics: emergency medicine; OBG/YN; dentistry, dermatology; ENT

10.201

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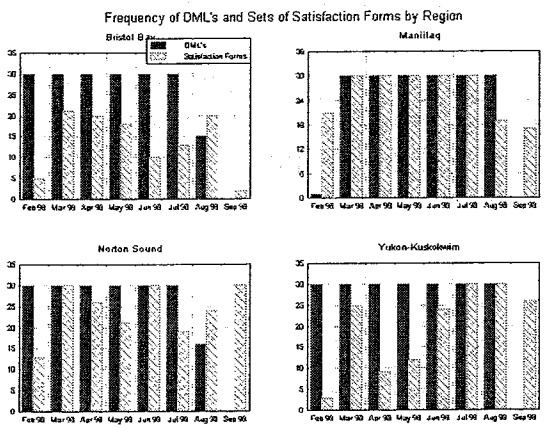
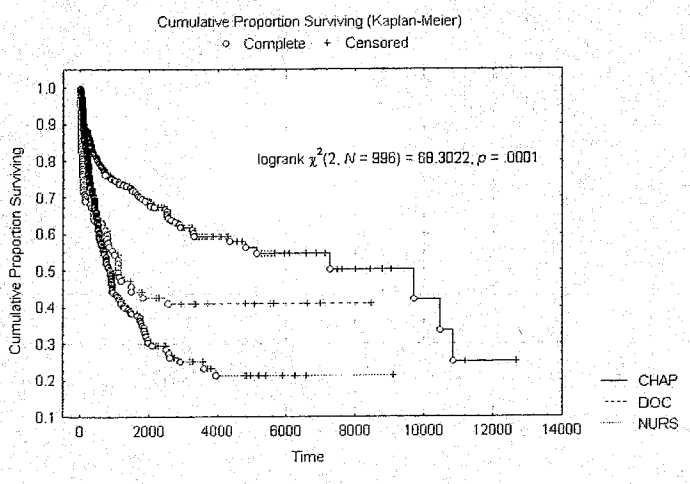
- The methods of analysis: based on power calculations; SAS analysis.



Satisfaction Data: Quality Control

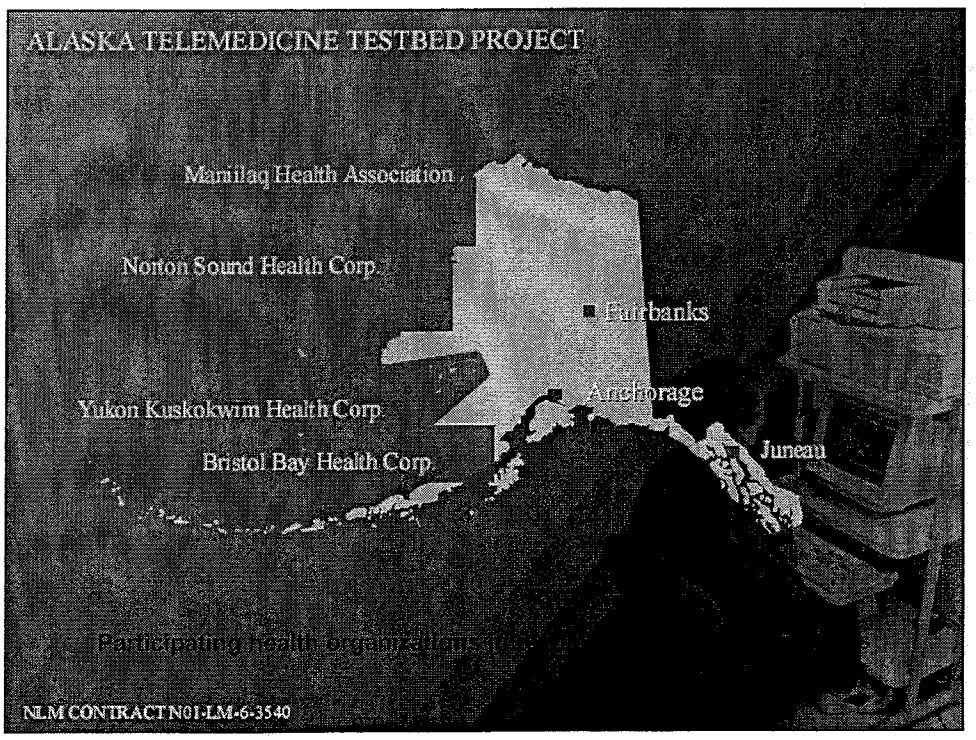


Preliminary Data for "Survival Analysis"

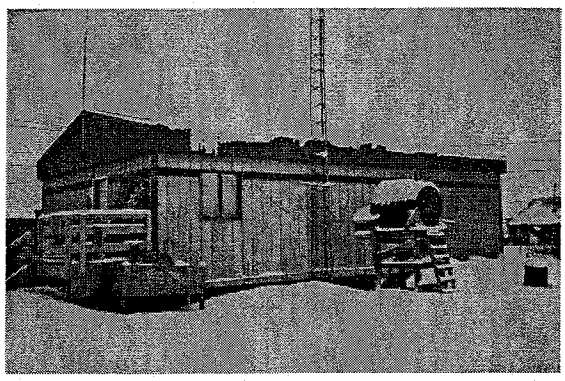
10.204

Where are you in the process, and what accomplishments do you expect in telemedicine evaluation by the conclusion of the contract?

We are in the process of solving final technical problems and believe that clinical encounters for ENT in rural Alaska will begin in January 1999



10.205



Noatak Clinic

Cheryl Booth (CHP) works on Maniilaq CIO Eugene Smith

10.206

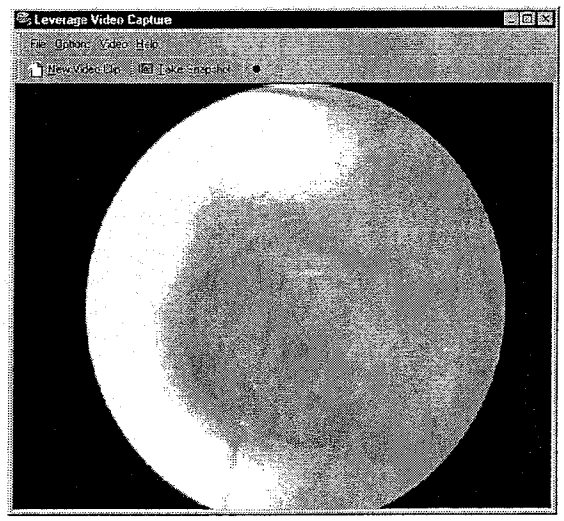
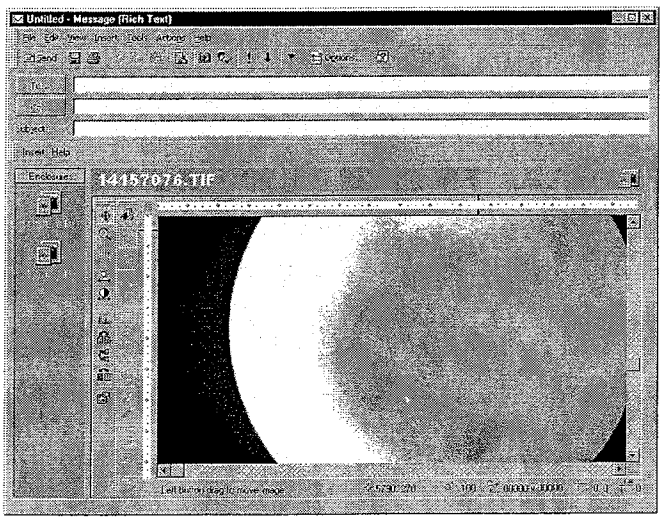


Image of ear is captured from the Otoscope into the Medical Desktop



Captured image is placed into the patients online chart

10.207

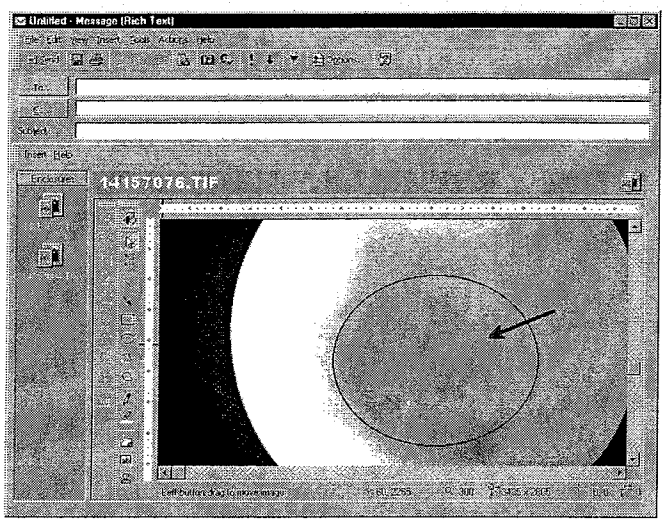


Image is annotated in an email message to await consult

Where are you in the process, and what accomplishments do you expect in telemedicine evaluation by the conclusion of the contract?

- Problems with chosen clinical software package

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- We have encountered every problem that we expected and others that were unexpected, especially regarding the politics of health care market share and the politics of information systems. For instance,Maniilaq IS Director told us that he wouldn't settle for "stopgap solution" when we prepared to abandon Medvision

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10.211

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- Region one equipment deployed to Maniilaq region

Where are you in the process, and what accomplishments do you expect in telemedicine evaluation by the conclusion of the contract?

Continued...

- Alaska Telehealth System continues to grow with more library and clinical information

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Continued...

- Alaska Telehealth System continues to grow with more library and clinical information
- Narrow bandwidth video conferencing system has been prototyped and will be deployed in Anchorage, Seward, Talkeetna, Bethel, Kotzebue, Dillingham, Nome

Where are you in the process, and what accomplishments do you expect in telemedicine evaluation by the conclusion of the contract?

Continued...

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- Narrow bandwidth video conferencing system has been prototyped and will be deployed in Anchorage, Seward, Talkeetna, Bethel, Kotzebue, Dillingham, Nome
- Developing ENT protocols

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Continued...

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- Working with wide range of health care providers: specialists in Anchorage; primary care doctors in regional centers like Kotzebue; nurse practitioners and physicians assistants; health aids in villages

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- Development of information flow system predicated on rural Alaska telecommunications

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- Development of information flow system predicated on rural Alaska telecommunications
- Development of Alaska Telemedicine Workstation
- Development of training materials

NLM, prior to the award of these contracts, sponsored two studies on (a) aspects of telemedicine evaluation and (b) data confidentiality. Have these resources been helpful to you in structuring, conducting, and analyzing your telemedicine evaluation research? If so, how? If not, how could they have been made more useful?

Yes, these studies have been valuable in evaluating telemedicine activities in rural Alaska.

- System assessment

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Yes, on some issues the studies were very helpful.

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The studies have not been as valuable on the following issues because of the nature of telecommunications and information technology in rural Alaska. Many issues do not apply to stated standards because of the nature of healthcare delivery in rural Alaska.

- Information security officers

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- Electronic authentication records

Ear Examination version 1.0

Alaska Telemedicine Testbed Project
NLM Contract # N01-LM-6-3540

Frederick W. Pearce, Ph. D.
Principal Investigator
Director, Applied Science Lab, UAA

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For more information about the Alaska Telemedicine Testbed Project please visit our web site at: http://appliedsci.uaa.alaska.edu/nlm

Ear Examination version 1.0

Alaska Telemedicine Testbed Project
NLM Contract # N01-LM-6-3540

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10.224

EXAMINING THE EAR

- A review of the words we use and the things we see

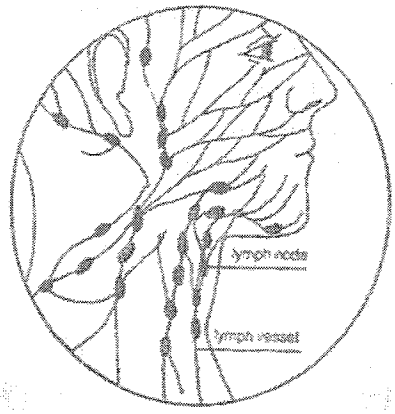
OUTER EAR

- Appearance
  - ABNORMAL: Redness and swelling of the tissue around the ear, or drainage from the ear canal

OUTER EAR

- Feel for lymph nodes. If lymph nodes are felt, describe:
  - Size
  - Tenderness
  - Mobility (are nodes moveable or do they feel like they are attached to the tissue beneath the skin)

OUTER EAR



10.226

OUTER EAR

- Press on the hard bone behind the ear (mastoid bone) to check for tenderness
  - NORMAL: Not tender

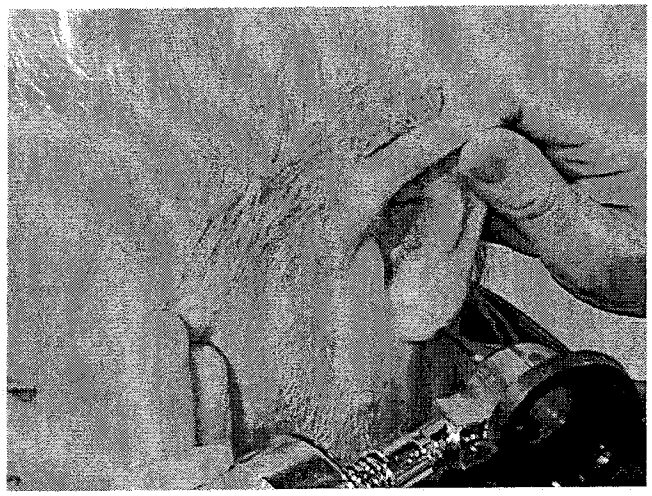
OUTER EAR

- Pull gently back on the ear and press gently on the tissue just in front of the ear
  - NORMAL: Not tender
  - ABNORMAL: Tenderness may indicate ear canal irritation or infection of the ear canal

10.227

OUTER EAR

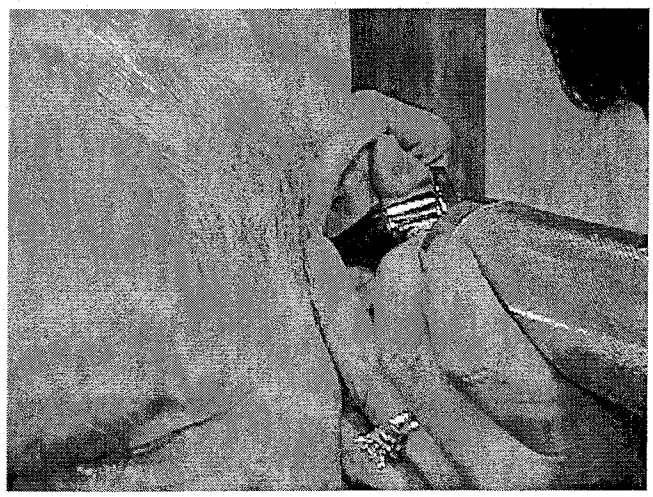
OUTER EAR



EAR CANAL

- Choose the largest speculum that will comfortably fit into the ear canal.
- Hold the otoscope and ear correctly. Rest the little finger or side of the hand against the patient's head to stabilize the otoscope and prevent injury if the patient moves.

EAR CANAL



EAR CANAL

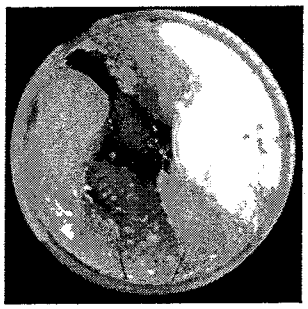
- NORMAL:
  - Skin of ear canal pink with a small amount of wax

EAR CANAL

- ABNORMAL:
  - A sore (lesion)
  - Blood

EAR CANAL

- ABNORMAL:
  - Dark pink or red color



EAR CANAL

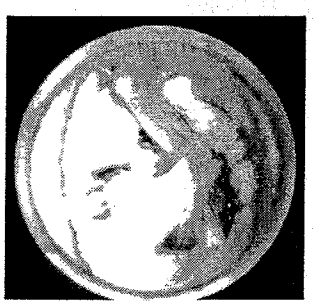
- ABNORMAL:
  - Swelling

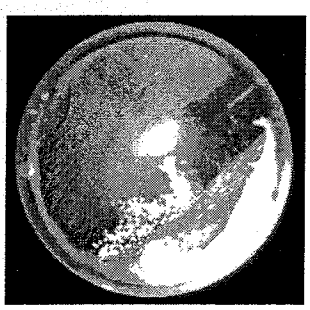
EAR CANAL

- ABNORMAL:
  - A lump or growth

EAR CANAL

- ABNORMAL:
  - Drainage (describe how much, what it looks like and smell)





10.232

EAR CANAL

- ABNORMAL:
  - Large amount of wax, or wax that blocks the canal

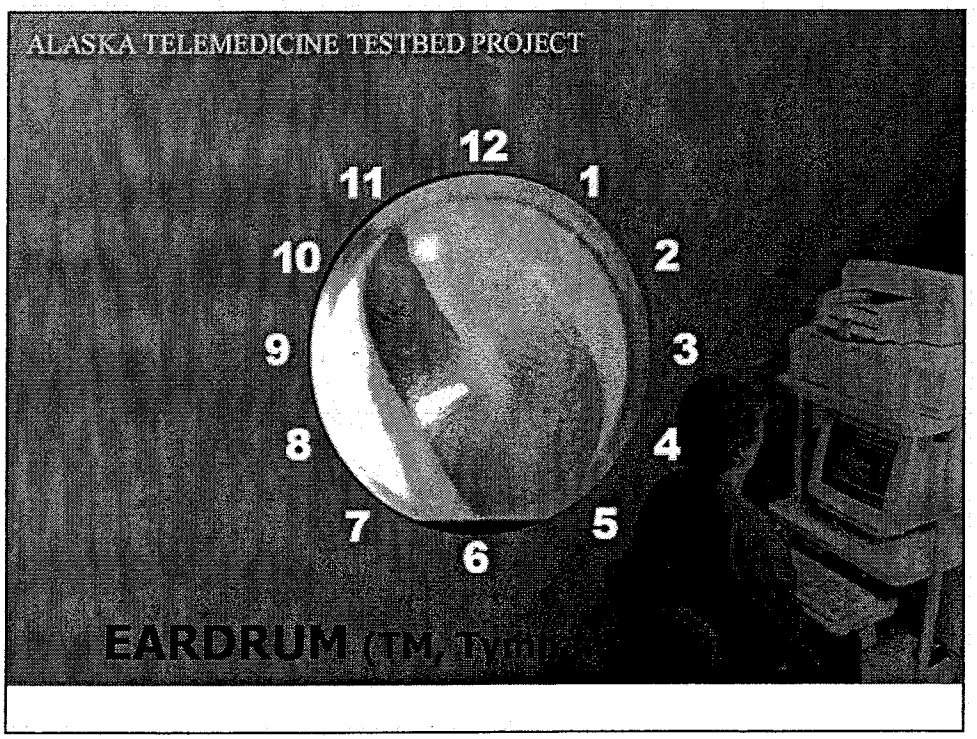
EAR CANAL

- ABNORMAL:
  - Foreign body

10.233

EARDRUM (TM, Tympanic Membrane)

- Move the speculum to get a good look at all of the TM, including the area above the malleus bone.
- You may find it useful to draw what you see, or use the face of a clock to help you describe your findings.

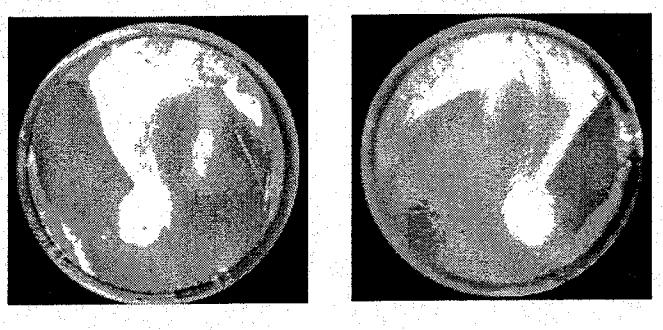


10,234

EARDRUM

- COLOR
  - NORMAL:
    - Grey color
      - In the newborn and very young infant the color may be pink, like the color under a fingernail, but NOT red
      - If the patient is crying or has a fever the TM may be pink or red
      - Tiny red blood vessels may be seen along the malleus bone in patient with URI, fever, or as a result of having their ear examined

EARDRUM



10.235

EARDRUM

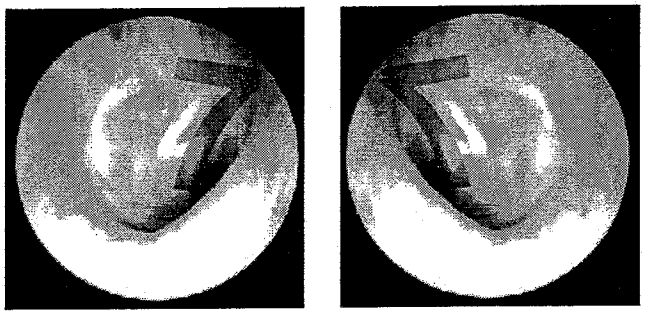
- POSITION
  - Look for the bone of the middle ear (malleus) to help you decide the eardrum's position. These bones are the "landmarks." The TM normally lies flat or "neutral" against the bones.
  - The eardrum itself curves slightly outward from where it touches the long part of the malleus.

EARDRUM (Position)

- NORMAL:
  - The malleus bone appears in the neutral (flat, normal) position.
    - On the RIGHT side, the malleus appears as a "7" behind the TM with the long handle extending downward toward the 6 - 7 o'clock position
    - On the LEFT side the malleus appears as a backward 7 behind the TM, with the long handle extending downward toward the 5 - 6 o'clock position

10.236

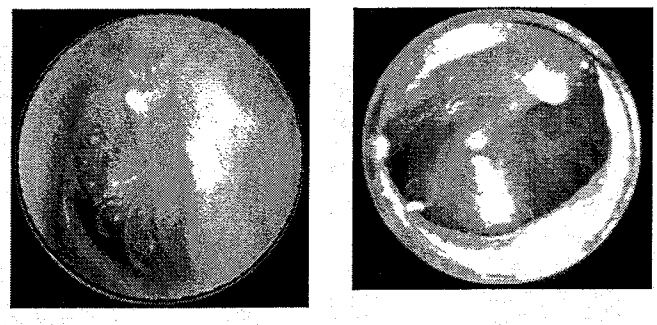
EARDRUM (Position)



EARDRUM (Position)

- ABNORMAL:
  - Retracted: The eardrum is pulled back tightly over the bone
    - The malleus (short process or elbow) appears sharp and more visible, as though it is sticking out toward you.
    - The long bone of the malleus may look shorter than normal, as though it is lifted or raised.

10,237



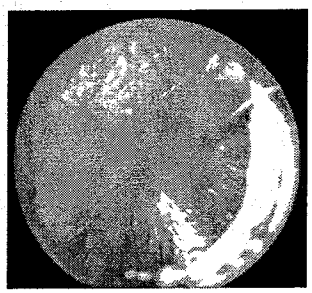
- Retracted TM with air and fluid bubbles visible

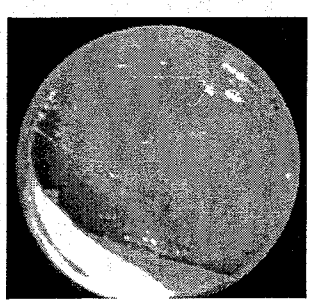
EARDRUM (Position)

- ABNORMAL:
  - Bulging: The eardrum appears pushed out from behind.
    - It may look as though you are looking a the top of an apple
    - You may not be able to see the bone at all
    - This is an important finding in order to make the diagnosis of acute otitis media

10.238

EARDRUM (Position)



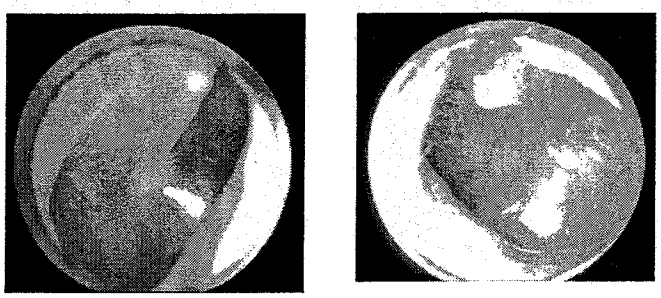


EARDRUM

- CLEAR OR CLOUDY (CLARITY OR VISIBILITY)
  - NORMAL:
    - Almost clear (transparent, translucent) and slightly shiny
  - ABNORMAL:
    - Dull
    - Hazy or Cloudy
    - Opaque - can not see through it

10.239

EARDRUM



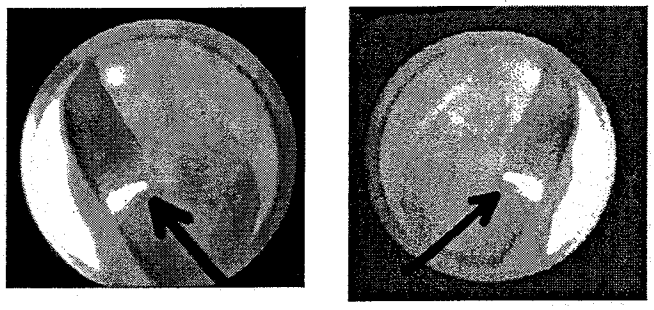
- Comparison of clear TM vs opaque

EARDRUM

- LIGHT REFLEX
  - A tiny triangle (cone) of shiny white light extending from the end of the bone to the edge of the eardrum
    - Toward the 5:00 o'clock position on the right
    - Toward the 7:00 o'clock position on the left

10.240

LIGHT REFLEX

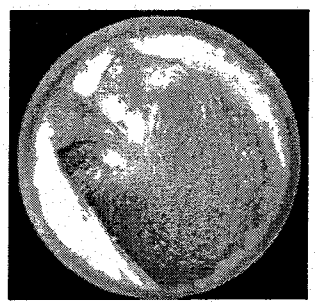


EARDRUM (Light Reflex)

- LIGHT REFLEX
  - The light reflex may be seen on a normal or abnormal eardrum
  - Changes in the POSTION of the eardrum will cause changes in the light reflex, and shift it's location. The reflex may appear as spot of light, scattered light or a broad reflection rather than a triangle, indicating a change in the position of the TM.

10.241

EARDRUM (Light Reflex)



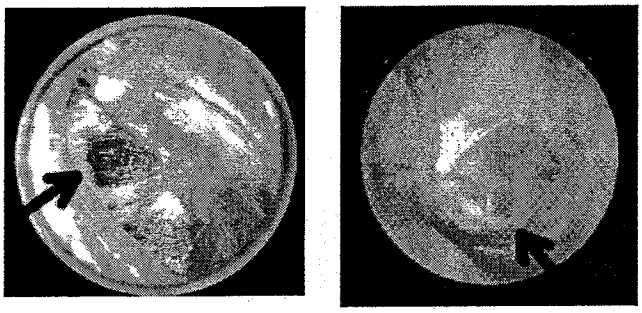
- This retracted rough TM does not reflect light normally. The light is scattered and does not create a normal cone.

EARDRUM

- SCAR
  - TYMPANOSCLEROSIS a chalky white color, caused by chronic fluid or infection

10.242

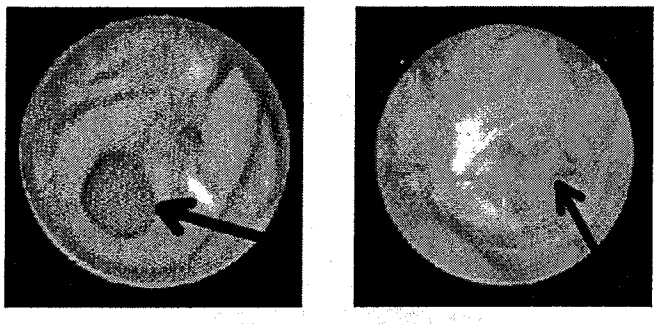
SCARRING OF THE TM



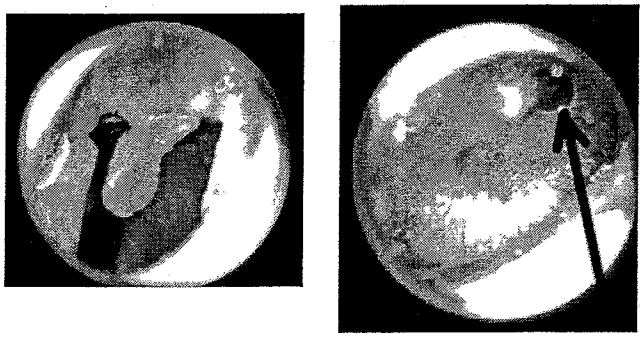
EARDRUM

- HOLE (perforation)
  - Sometimes, what looks like a hole is actually a thin layer of eardrum that has healed to cover a hole. When you examine for mobility, the thin area will move. If it is a hole, it will not move.

EARDRUM

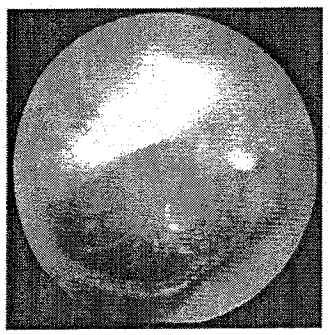


EARDRUM



EARDRUM

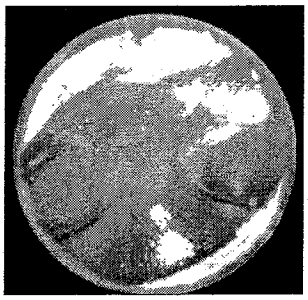
- BUBBLES
  - Air and fluid may be seen behind the eardrum

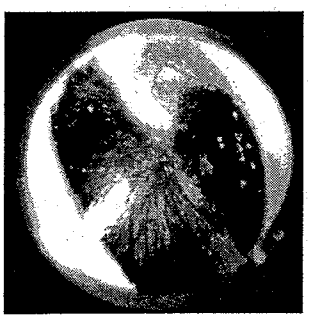


EARDRUM

- FLUID LEVEL
  - If fluid is seen behind the eardrum, describe it
    - Clear
    - Cloudy
    - Bloody

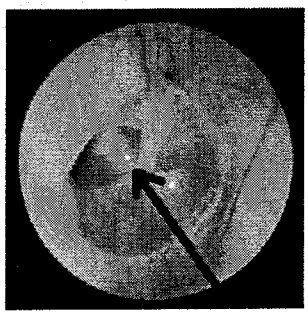
EARDRUM





EARDRUM

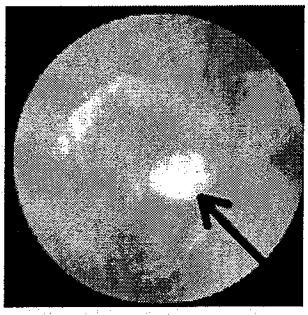
- RETRACTION POCKET
  - A dimple in the upper portion of the TM which may look like a perforation



Eardrum

- CHOLESTEATOMA
  - Shiny growth, pearly-white or silver color made up of dead cells that gather in a retraction pocket
  - Often seen in the upper portion of the ear drum or through a hole at the edge of the eardrum
  - May be noticed as sloughing or breakdown of the surface cells of the eardrum

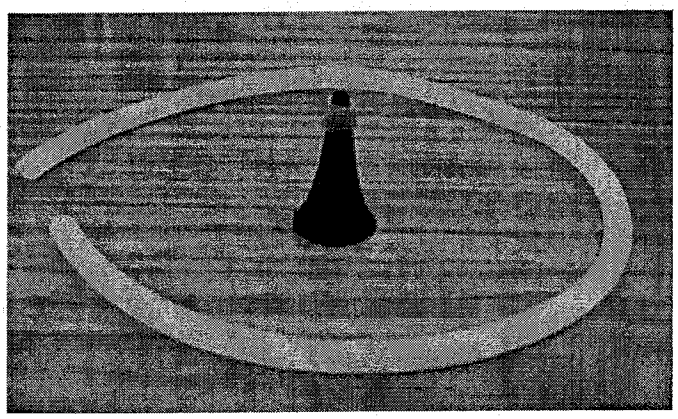
CHOLESTEATOMA



EARDRUM

- MOBILITY
  - Properly seal the ear canal, using the largest speculum possible.
  - It may be necessary to place a small piece of soft tubing around the tip of the speculum to insure a seal.

EARDRUM



EARDRUM

- MOBILITY
  - Watch as you blow and suck (push and pull) gentle puffs of air through the tubing.
  - If you have a good seal, it only takes 1/3 - 1/2 of a squeeze of the bulb to test mobility.
  - Forcing too much air will be uncomfortable for the patient.
  - DO NOT do this exam if the ear is draining pus. Draining pus means there is a hole in the TM.

HEARING

- If you are examining an infant or young child, check hearing by making a soft sound behind the child's head, so the child can not see you.
  - Very young children may change activity, listening for the sound.
  - Older infants and young children may turn to find the sound.
  - Older children and adults can be tested using a ticking watch, whispered numbers or short clearly spoken words.
  - Verify that the hearing is equal. Do they hear the ticking watch to an equal distance as the watch is slowly moved away from their ear?

DESCRIBING THE EARDRUM

- COLOR
  - Normal:
    - Gray
    - If crying: pink/red
    - Tiny blood vessels seen along the malleus bone
  - Abnormal:
    - Any color other than gray
    - Yellow
    - Red
    - Blue/Black

DESCRIBING THE EARDRUM

- POSITION
  - Normal:
    - Neutral
    - Normal landmarks
    - Flat
  - Abnormal:
    - Retracted
    - Bulging

10.250

DESCRIBING THE EARDRUM

- CLEAR OR CLOUDY
  - Normal:
    - Clear
    - Transparent
  - Abnormal:
    - Dull
    - Hazy or Cloudy
    - Opaque
    - Thick

DESCRIBING THE EARDRUM

- OTHER APPEARANCE
  - Normal:
    - Light reflex "cone of light" with base at about 5:00 o'clock on R and 7:00 o'clock on L
    - Smooth
  - Abnormal:
    - Scar
    - Hole
    - Bubbles
    - Fluid level
    - Wrinkled surface
    - Growth

DESCRIBING THE EARDRUM

- MOBILITY
  - Normal:
    - Eardrum moves easily both in and out when air is pushed against it or sucked away from it
  - Abnormal:
    - Slow (sluggish)
    - Decreased (hardly moves)
    - Moves only when air is pulled or sucked out - negative pressure
    - Immobile

Alaska Telemedicine Testbed Project

Telemedicine and Telecommunications: Options for the New Century

William H. Natcher Conference Center
National Institutes of Health
Bethesda, MD
March 13 - 14, 2001

NLM Contract N01-LM-6-3540
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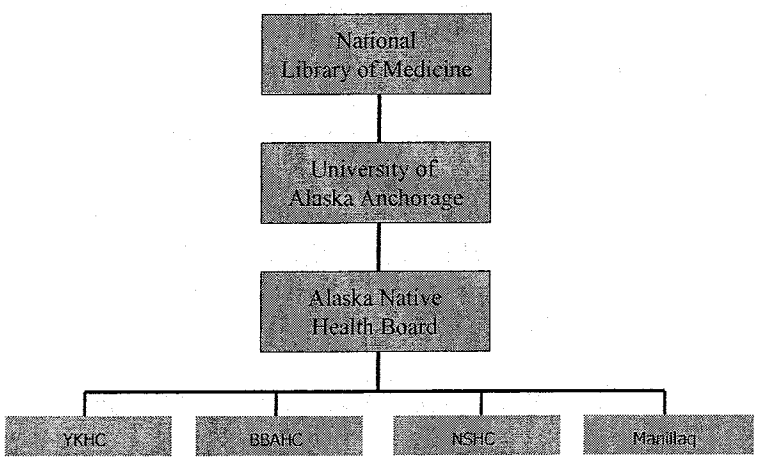
Askar Choudhury, Ph.D.	ATTP Satisfaction Study
Matt Berman, Ph.D.	ATTP Cost & Benefits Study
Denise Statz, PA-C	ANHB Project Manager
Destyne Taft	Training Materials Producer
Greg Storey	Presentation Designer

10.253



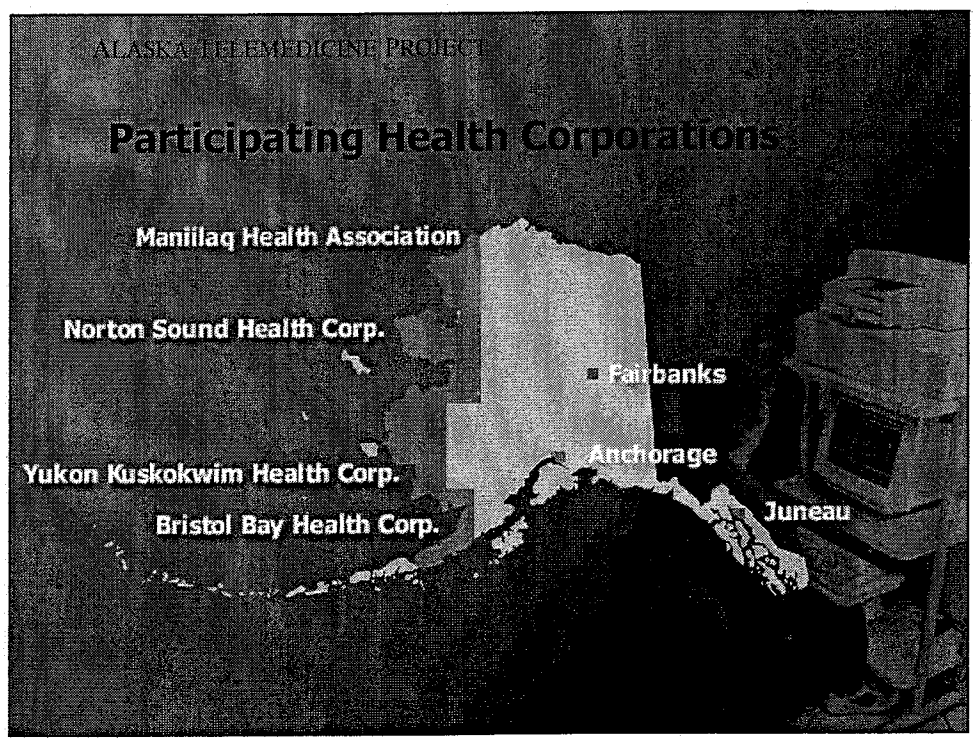
Basic Research Model

* Alaska data are being compared to 1996 transportation records for IHS and Providence Health Systems in Alaska; data analysis revealed 90,000 air transports from rural Alaska to Anchorage in five clinics: emergency medicine; OBG/YN; dentistry, dermatology; ENT

* ENT was chosen as clinical focus of study because of the 4,500 transports for ENT; the statistical significance of ENT across the regions (no gender or age bias); and because of the severity of otitis media in rural Alaska

Basic Research Model

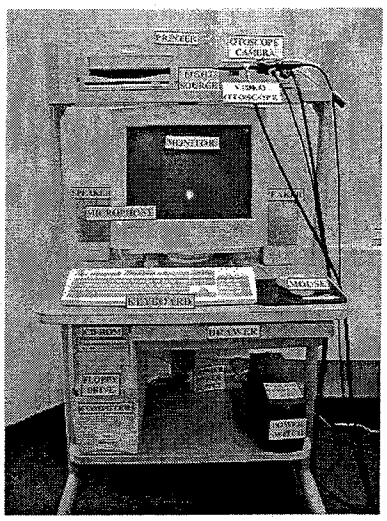
* The experimental design: interrupted time series model; villages and regions are compared to themselves in pre-and post-intervention model
* Data collection: retention data have been collected and processed; satisfaction data has been collected since Feb. 16, 1997 and continues; antibiotics data collection is completed, cost and benefit data has been requested from participating Alaska Native health corporations
* The methods of analysis: based on power calculations; SAS analysis.



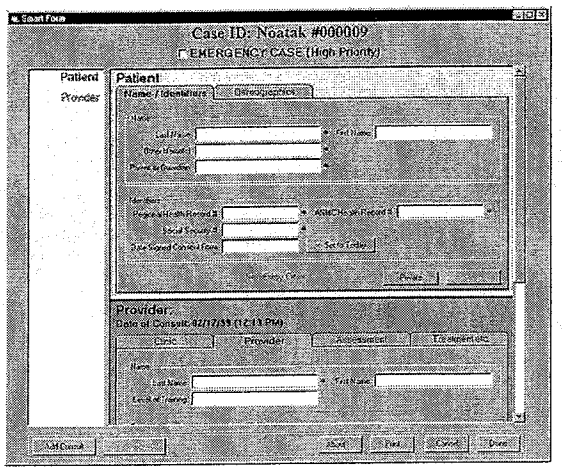
Work Session December 1998

Deployment

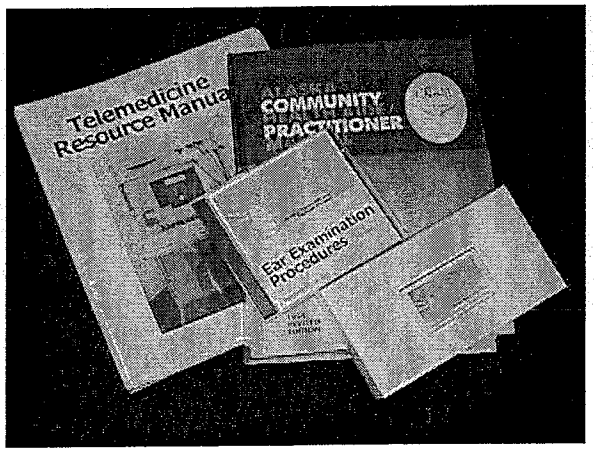
ATTP Workstation



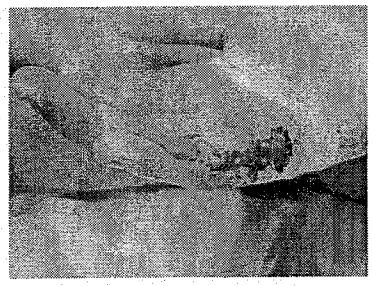
ATTP Software

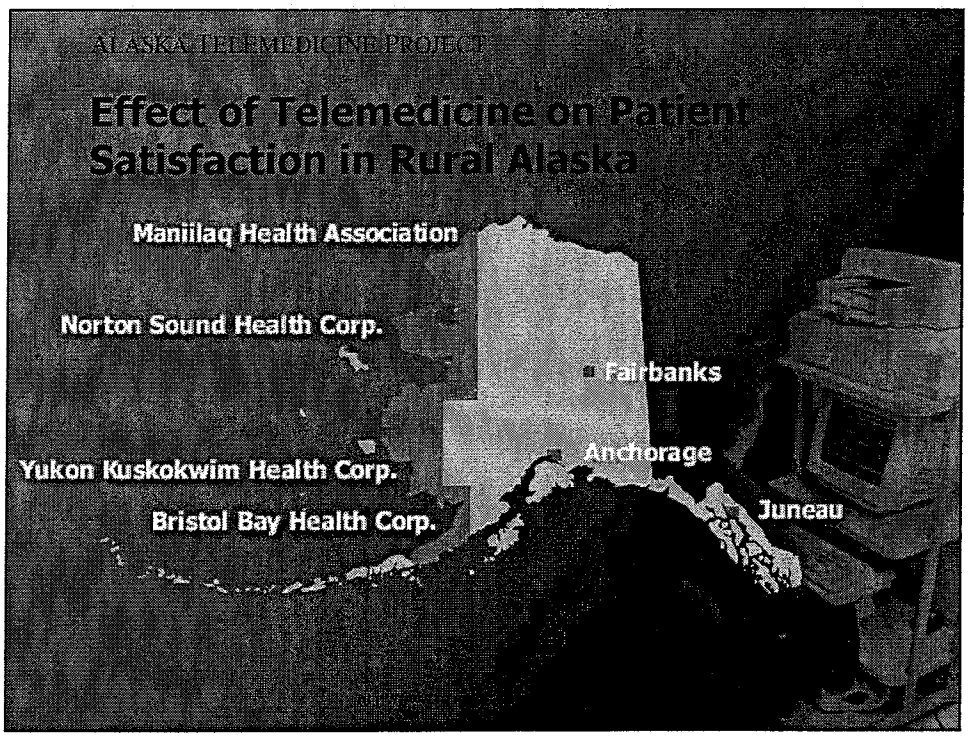


Training Materials



Training

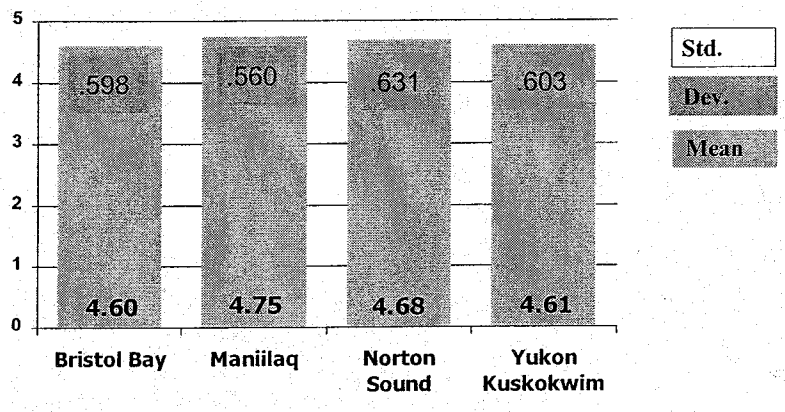




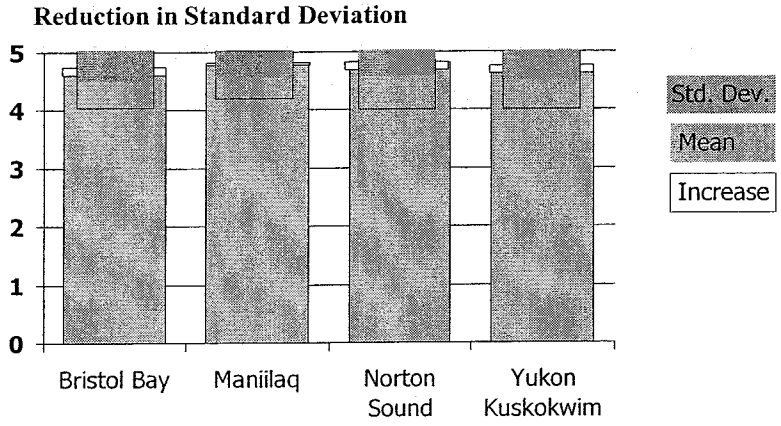
Hypothesis

- Will effectively designed, deployed, and supported telemedicine and telehealth applications increase the patients' overall "satisfaction" of healthcare?

Average Patient Satisfaction Level (Before Telemedicine)

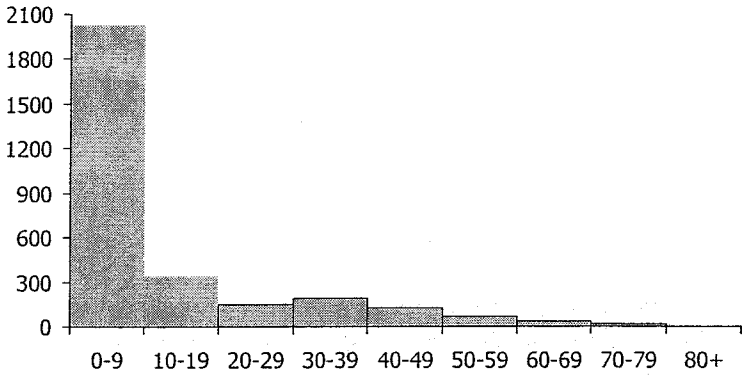


Patient Satisfaction (After Telemedicine)

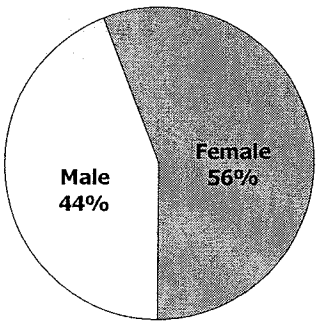


10.261

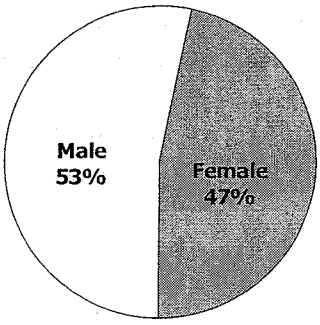
Age of Patient



Gender



by Patient
1998 Surveys



by Population
1990 Census

Overall Patient Satisfaction Model for Maniilaq Health Corporation

$$y = 0.14 + 0.15sex + 0.28Q_2 + 0.19Q_3 + 0.40Q_4 + -0.13\ Q_2\ sex$$

p-value = 0.00470.0405 <.0001 <.0001 <.0001 0.0047

Q_2 = I am satisfied with the amount of time the Provider spent with me

Q_3 = The Provider understood my needs and concerns

Q_4 = I am satisfied with the treatment provided for my health problem.

Hypothesis

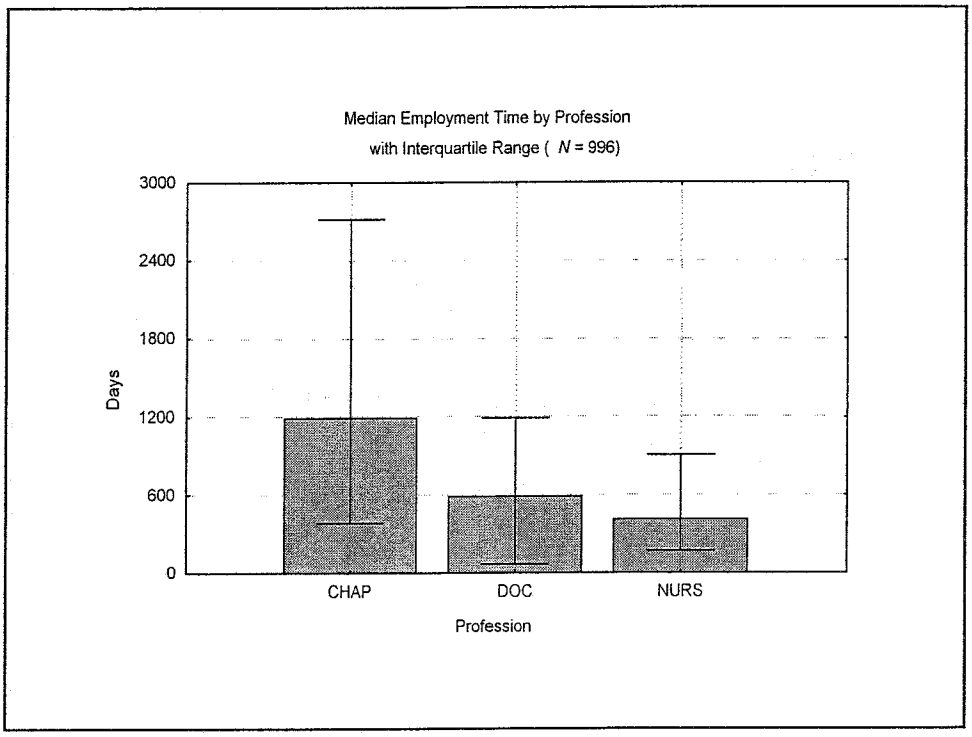
- Will the implementation of effectively designed, deployed and supported telemedicine and telehealth applications significantly increase the employment retention of healthcare providers in rural Alaska?

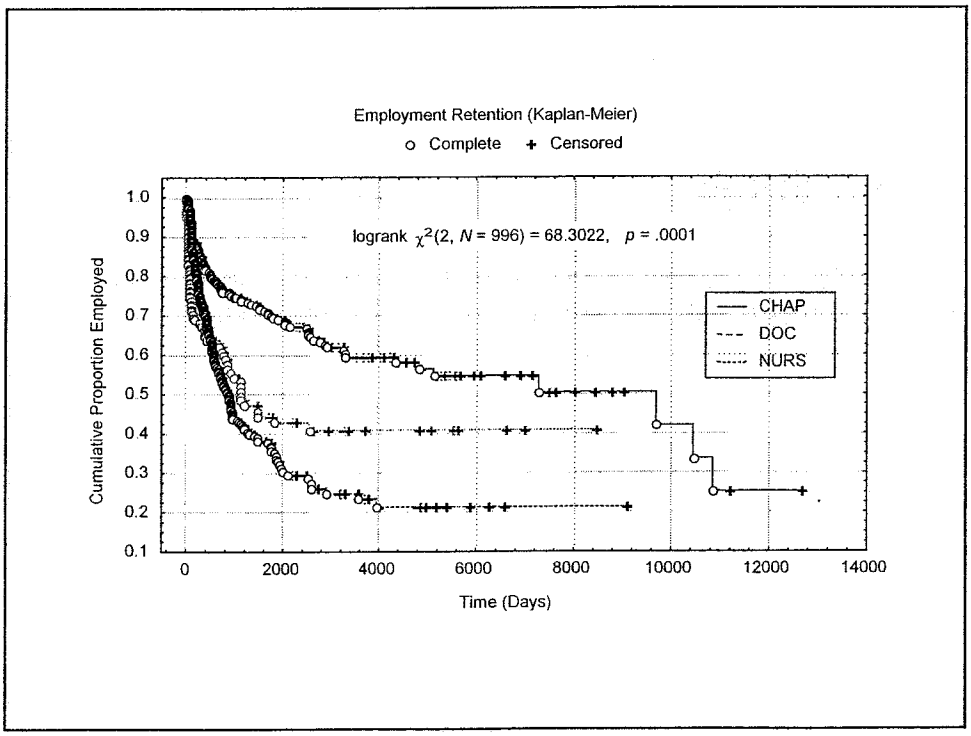
Methods

- Obtain data files from each region that includes: hire date, termination date, and position title for all doctors, nurses, and health aides.
- Compare Kaplan-Meier product limit survival curves of employment length before versus after telemedicine implementation.

Findings

- 57% of data points are censored (that is, employees had not been terminated by the time of data file construction).

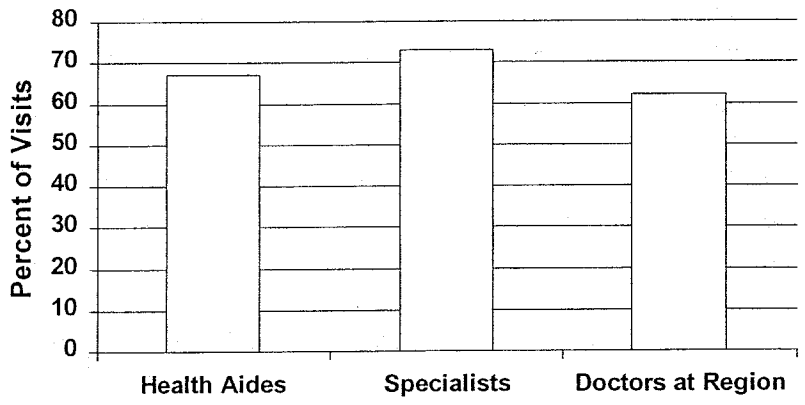

Median Employment Time by Profession
with Interquartile Range (N = 996)
3000
2400
1800
1200
600
0
Days
CHAP
DOC
NURS
Profession


Employment Retention (Kaplan-Meier)
o Complete + Censored
logrank $\chi^2(2, N = 996) = 68.3022$, $p = .0001$
CHAP
DOC
NURS
Cumulative Proportion Employed
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
2000
4000
6000
8000
10000
12000
14000
Time (Days)

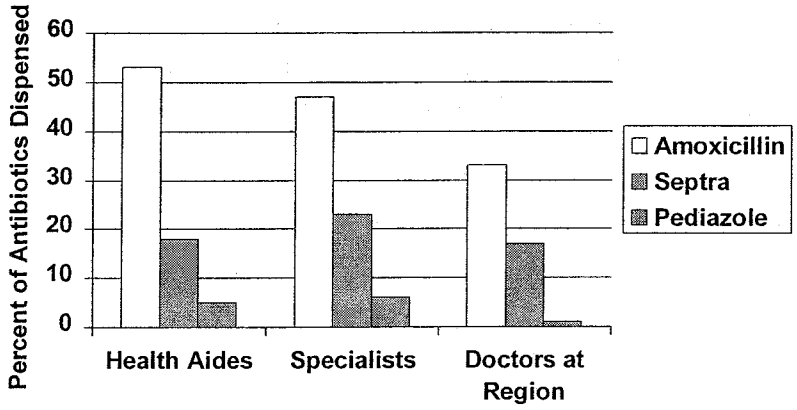
Hypothesis

- Will the implementation of effectively designed, deployed and supported telemedicine and telehealth applications significantly affect the antibiotic use in rural Alaska?

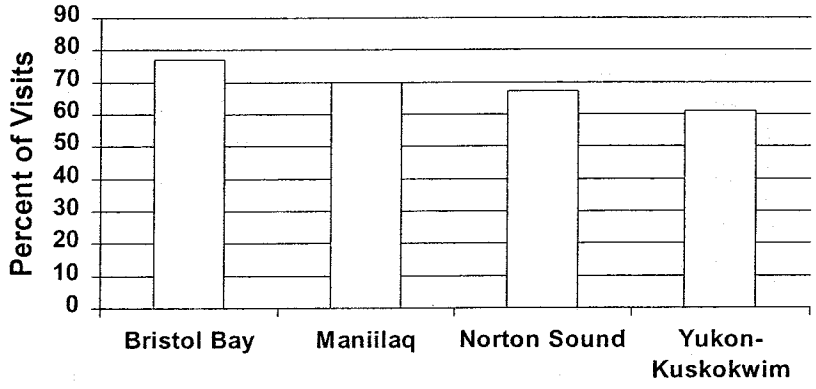
Antibiotics Dispensed by Provider



Top 3 Antibiotics Dispensed by Provider



Antibiotics Dispensed, by Region (Health Aides only)

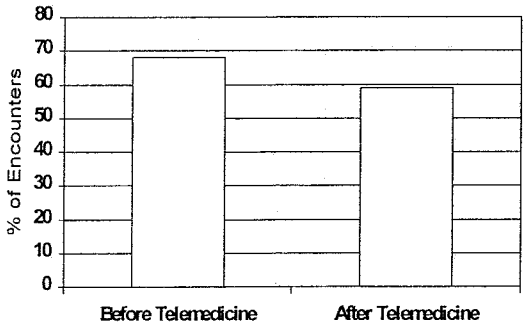


χ^2 (3, n = 2908) = 29.7, p < .001

Antimicrobial overprescription contributes to bacterial resistance

* The diagnosis of otitis media accounts for a large proportion of antibiotic prescription, particularly among young children
* Consultation with ENT specialists via telemedicine equipment may result in more judicious dispensation of antibiotics by village health aides

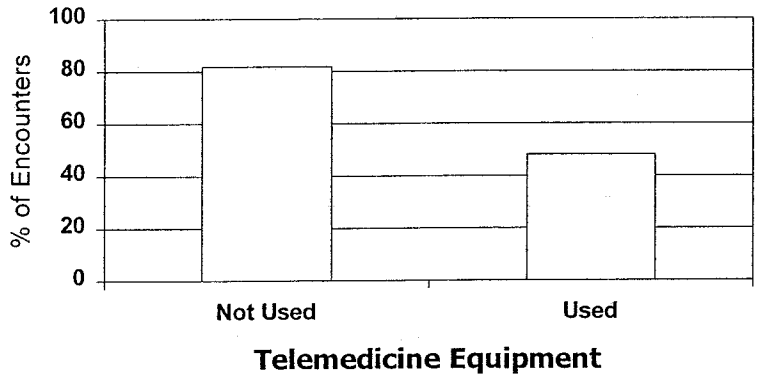
% of Encounters in Which Antibiotics were Dispensed



$\chi^2(1, \underline{n} = 4039) = 20.34, \underline{p} < .001$

- Hypothesis
- After implementation of telemedicine equipment, is there an association between *use* of the equipment and antibiotic dispensation by village health aides?

% of Encounters in Which Antibiotics were Dispensed



$\chi^2(1, \underline{n} = 507) = 60.44, \underline{p} < .001$

- Does the association between use of telemedicine and antibiotic dispensation hold after controlling for potential confounders?
  - –Severity of the case
  - –Age of the patient

Logistic Regression Model Predicting Dispensation of Antibiotics by Health Aides

Variable	OR	LCL UCL
Gender	1.30	0.87, 1.98
Age (5 yrs)	0.99	0.89, 0.99
Orders	2.12	1.34, 3.35
Sent to Region	0.28	0.11, 0.70
No Telemed	**6.22**	**3.92, 9.87**

$\chi^2(8) = 9.31$, $p = .32$

10.270

Conclusions

- Deployment and use of ENT-related telemedicine equipment is associated with a decrease in the dispensation of antibiotics by village health aides, even when controlling for potential confounders.

Hypothesis

- Will the implementation of an effectively designed and implemented telemedicine system increase the "benefit" of health care delivery in rural Alaska?

10.271

Benefits Analysis

- Telemedicine Benefits assumptions
  - health care service must be "as good or better" than current service based on transportation
  - ENT services may be cost justified against transportation costs
  - benefits must be viewed in terms of the "cost per transaction"

Benefits Analysis

- Rural health providers have looked to telemedicine as a technology to reduce costs. However, virtual access to physicians and specialists may alter patients' demand for face-to-face physician access.
- We develop a model of service demand under managed care, and apply the model to a telemedicine application in rural Alaska. Provider-imposed delays and patient costs were highly significant predictors of patient contingent choices in a survey of ENT clinic patients.
- The results suggest that telemedicine reduced the mean patient loss from rationing of physician access by 46 percent, or about $25 per visit.

Benefits Analysis

- estimate that a telemedicine innovation increased estimated patient benefits by about 20 percent, and reduced the estimated loss from rationing of access to physicians by 46 percent.

Benefits Analysis

- In this rural Alaska managed care case, the technological innovation increases the value of the provided service and reduces the value of the rationed service.
- Introduction of telemedicine reduces the patient's average loss from service rationing from $54 to $29 per visit.

Estimated "value-added" of telemedicine (N = 497)

- value to patient (parent's of patient)
- two models incorporating travel cost and health care rationing in rural Alaska
- value per event is $25 (this is the increased value of the health aide visit to the patient when telemedicine is used)

Hypothesis

- Will the implementation of effectively designed, deployed and supported telemedicine and telehealth applications be cost effective given rural Alaska's great distances, low population density, "third world" telecommunications infrastructure, and current "transportation-based" system of healthcare delivery?

Cost Analysis

- Cost benefit assumptions:
  - "sustainability" is the ability for the Native Health Corporation to pay for the healthcare service
  - in rural Alaska you can't "make up the difference in volume"
  - health care service must be "as good of better" than current service based on transportation
  - ENT services may be cost justified against transportation costs
  - cost benefit must be viewed in terms of the "cost per transaction"

Findings and Discussion

- More than 1,800 ENT clinical events logged
- ATTP system designed for ENT; used for ENT, Dermatology, EM
- Patients' and Providers' "satisfaction" related to training and support
- Provider "survival" data suggests that telemedicine and telehealth applications do not increase the length of stay of healthcare providers in rural Alaska

Findings and Discussion

- Cost benefit analysis needs to be conducted with data from all four Alaska Native Health Corporations one year and three years after implementation
- The Alaska Telemedicine Testbed Project has received a one-year continuation of funding from the National Library of Medicine to complete Cost benefit analysis

Preliminary Conclusions

- Rural health care providers, especially the Community Health Aides, "love" the ATTP system and "don't know how they were able to do their jobs before the telemedicine system"
- As the result of the Alaska Telemedicine Testbed Project, Alaska's Congressional delegation has designated funding through IHS, VA, DOD, and DOT appropriations to deploy the ATTP system to all 235 villages and communities in rural Alaska

ALASKA TELEMEDICINE PROJECT

CANTO
Caribbean Association of National Telecommunication Organizations

17th Annual Conference

May 30, 2001

San Juan, PR

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Principal Investigator

Applied Science Laboratory
University of Alaska Anchorage
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ALASKA TELEMEDICINE PROJECT

Frederick W. Pearce, Ph.D.	Principal Investigator, ATTP Project
Dennis G. Fisher, Ph.D.	Director, ATTP Evaluation
Andrea Fenaughty, Ph.D.	ATTP Quality Control
Askar Choudhury, Ph.D.	ATTP Satisfaction Study
Matt Berman, Ph.D.	ATTP Cost & Benefits Study
Denise Statz, PA-C	ANHB Project Manager
Heidi Hammond	Training Materials Producer
Greg Storey	Presentation Designer

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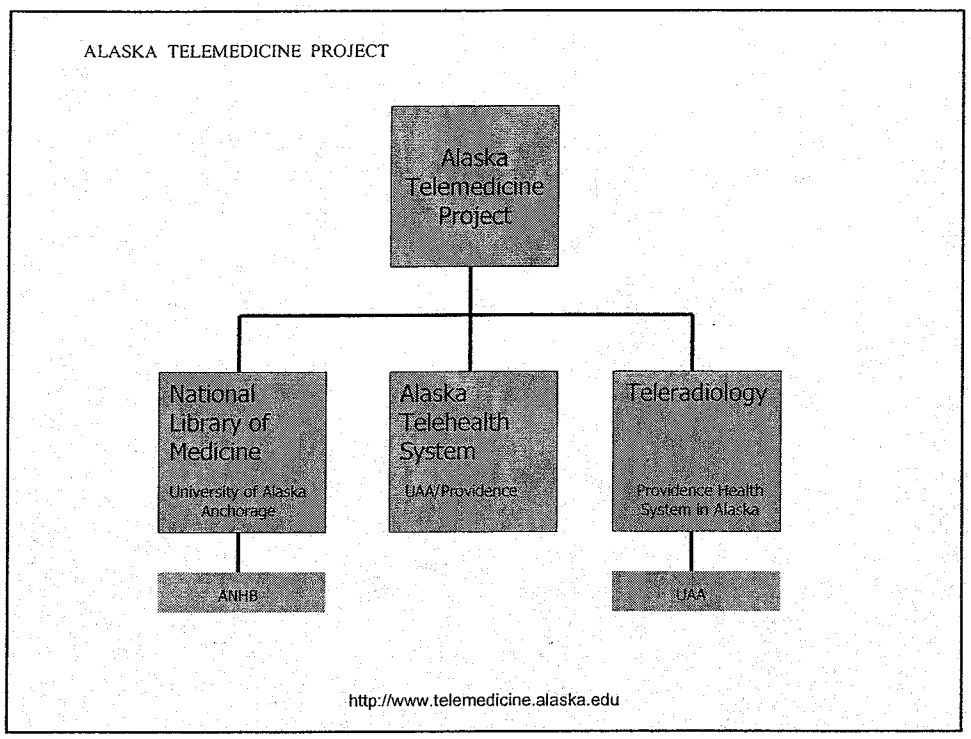
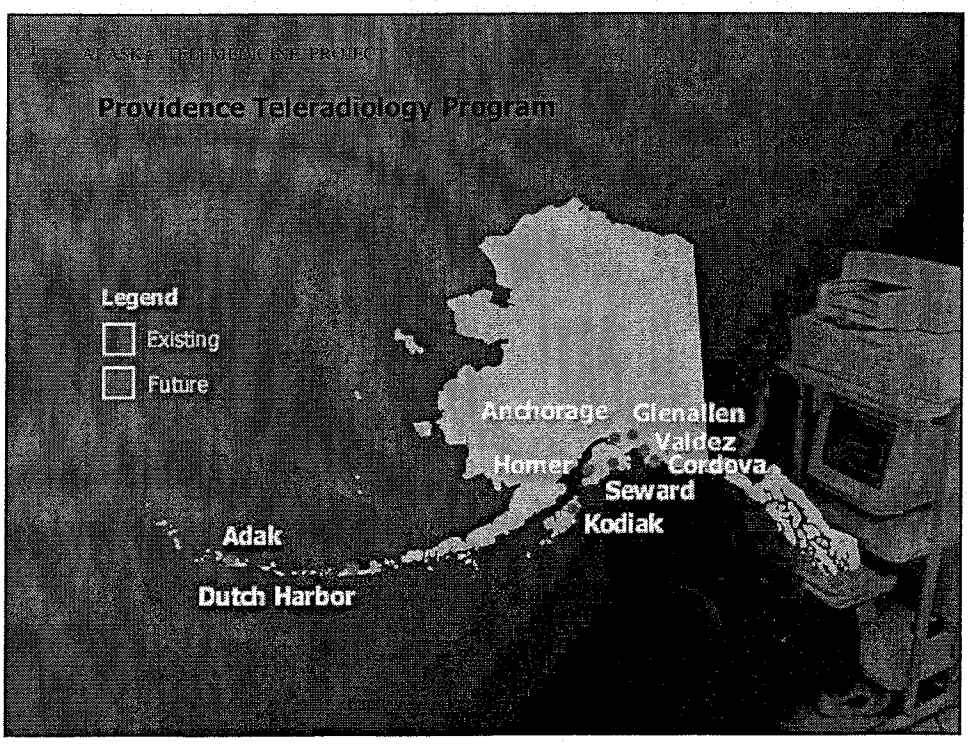

ALASKA TELEMEDICINE PROJECT
Alaska Telemedicine Project
National Library of Medicine
University of Alaska Anchorage
Alaska Telehealth System
UAA/Providence
Teleradiology
Providence Health System in Alaska
ANHB
UAA
http://www.telemedicine.alaska.edu


Providence Teleradiology Program
Legend
Existing
Future
Anchorage
Glenallen
Valdez
Homer
Cordova
Seward
Kodiak
Adak
Dutch Harbor

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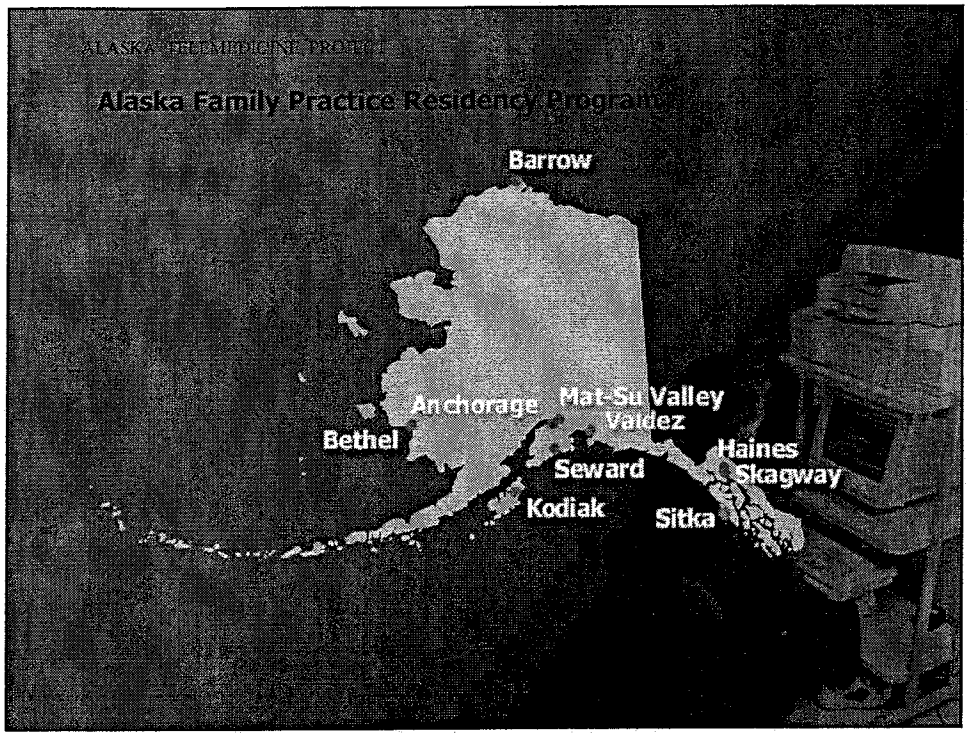
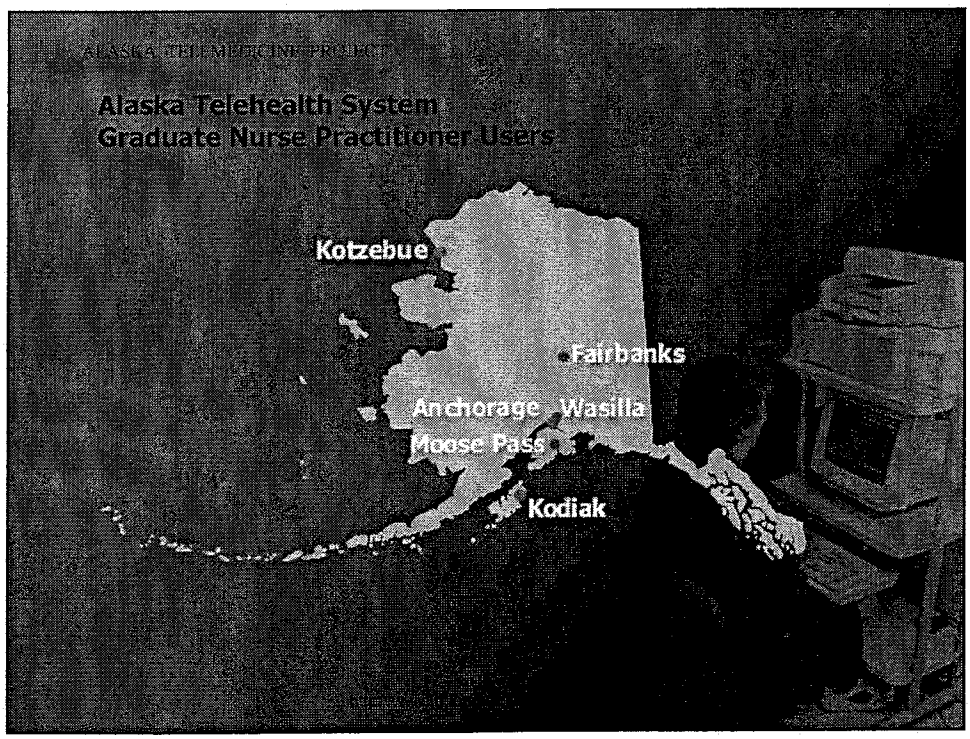

ALASKA TELEMEDICINE PROJECT
Alaska Family Practice Residency Program
Barrow
Anchorage
Mat-Su Valley
Valdez
Bethel
Haines
Seward
Skagway
Kodiak
Sitka


ALASKA TELEMEDICINE PROJECT
Alaska Telehealth System
Graduate Nurse Practitioner Users
Kotzebue
Fairbanks
Anchorage
Wasilla
Moose Pass
Kodiak

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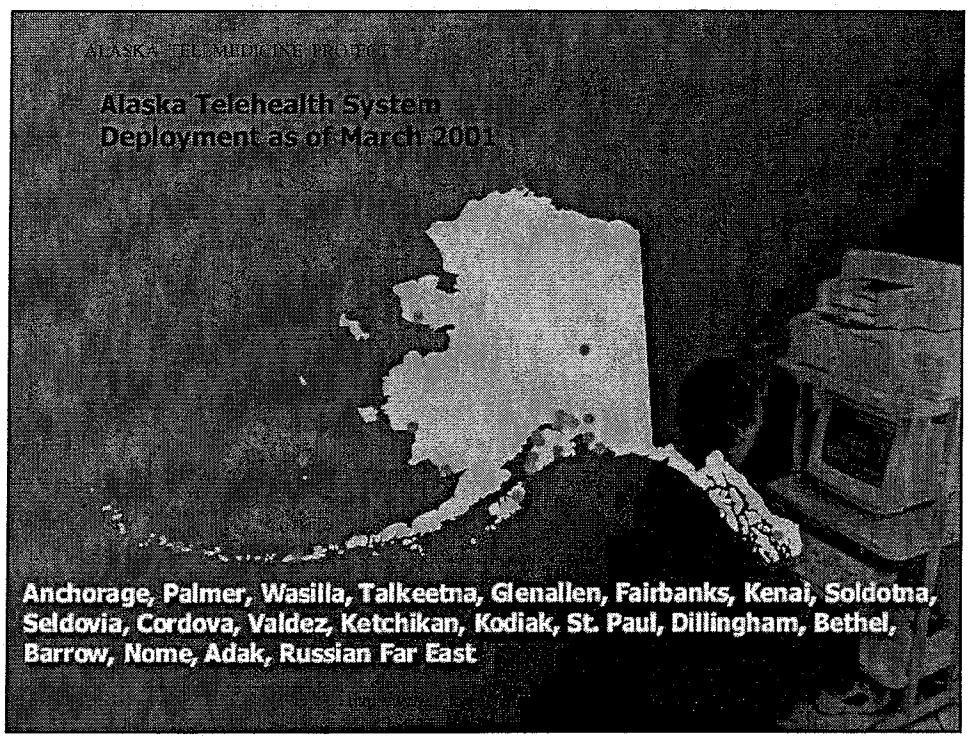
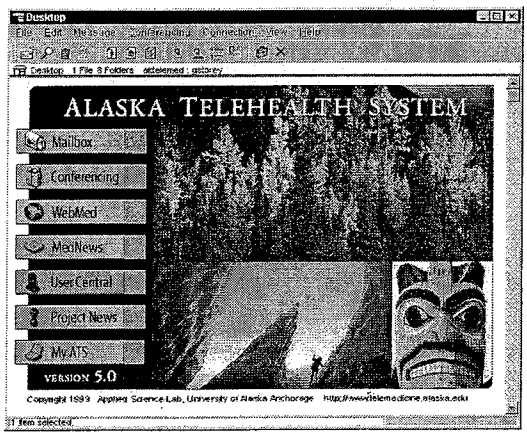


ALASKA TELEMEDICINE PROJECT

UDP/IP client for sub-4800 bps dial-up or IP work



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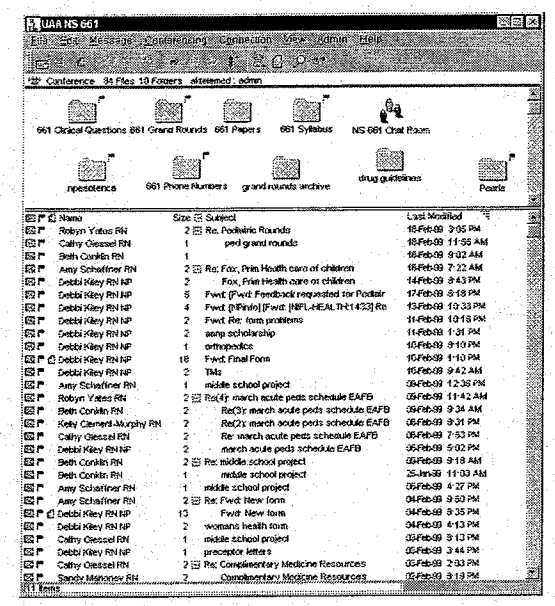
ALASKA TELEMEDICINE PROJECT



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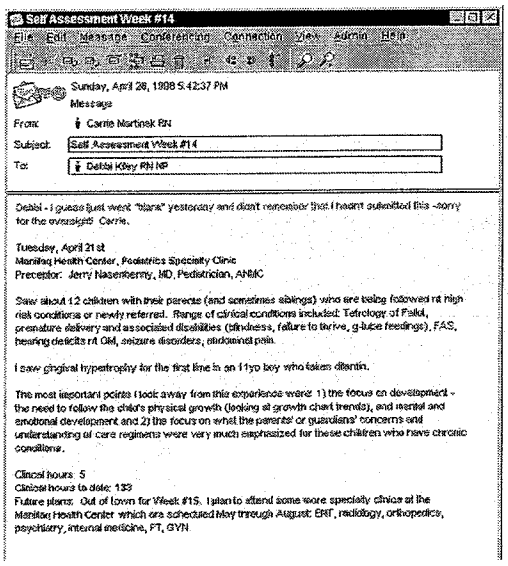

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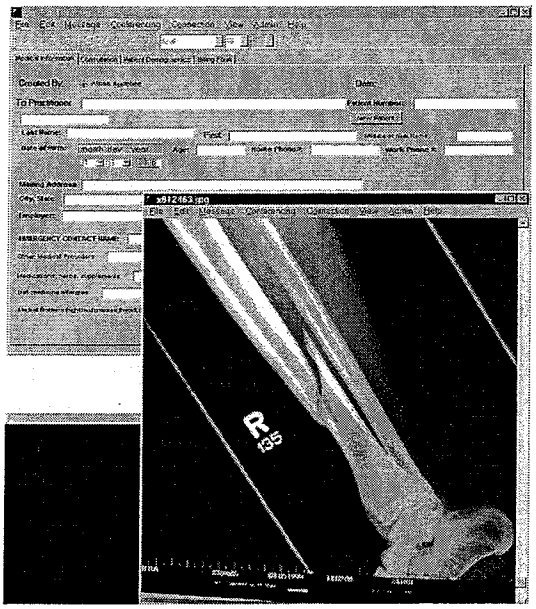

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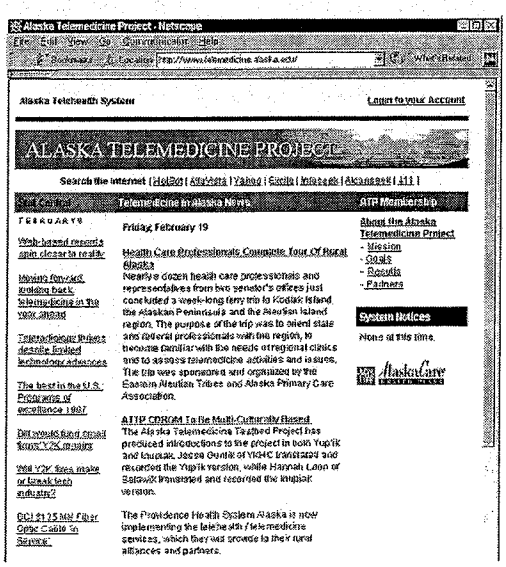

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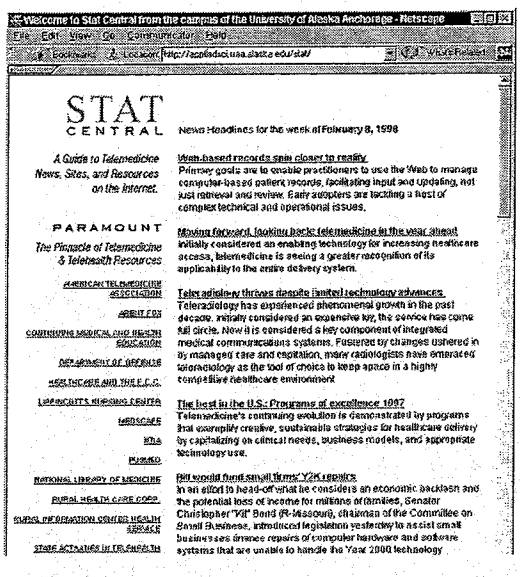

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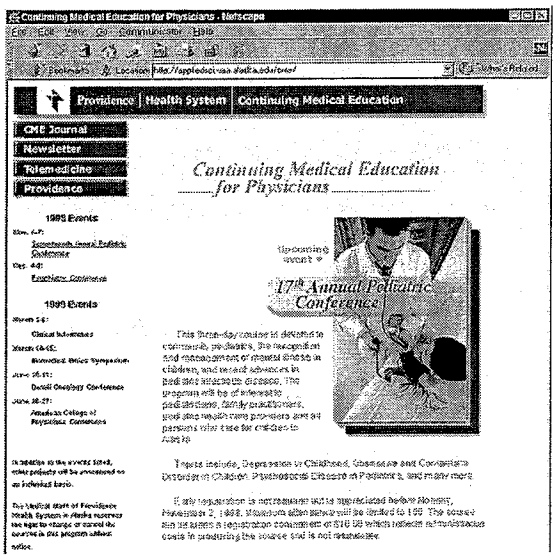

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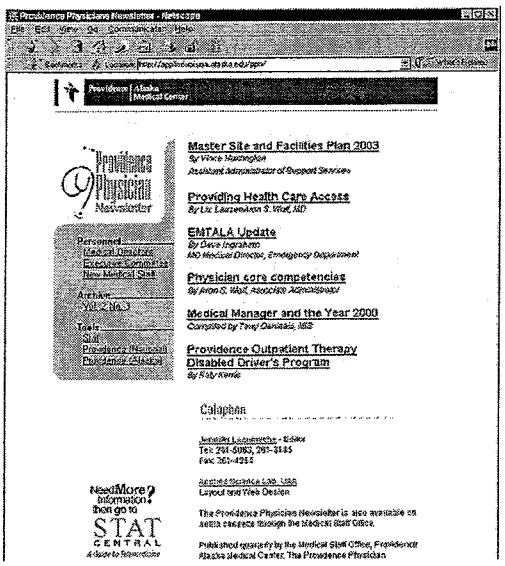

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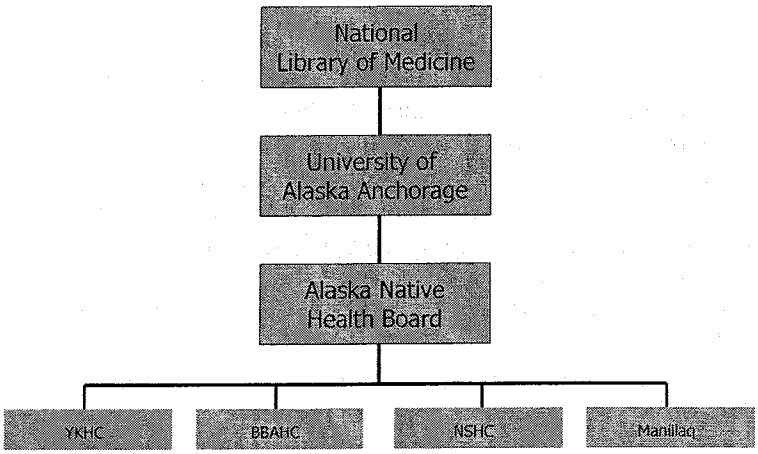

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ALASKA TELEMEDICINE PROJECT

Basic Research Model

* Alaska data are being compared to 1996 transportation records for IHS and Providence Health Systems in Alaska; data analysis revealed 90,000 air transports from rural Alaska to Anchorage in five clinics: emergency medicine; OBG/YN; dentistry, dermatology; ENT
* ENT was chosen as clinical focus of study because of the 4,500 transports for ENT; the statistical significance of ENT across the regions (no gender or age bias); and because of the severity of otitis media in rural Alaska

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ALASKA TELEMEDICINE PROJECT

Basic Research Model

* The experimental design: interrupted time series model; villages and regions are compared to themselves in pre-and post-intervention model
* Data collection: retention data have been collected and processed; satisfaction data has been collected since Feb. 16, 1997 and continues; antibiotics data collection continues, cost and benefit data has been obtained from participating Alaska Native health corporations and is being analysed
* The methods of analysis: based on power calculations; SAS analysis.

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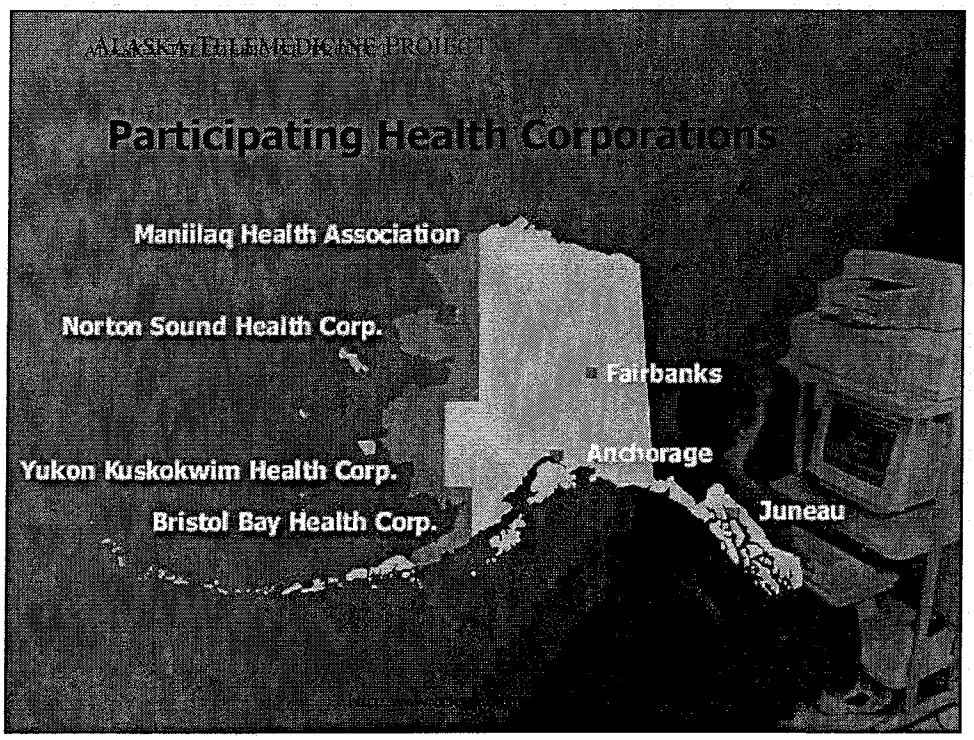

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Work Session December 1998

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Deployment

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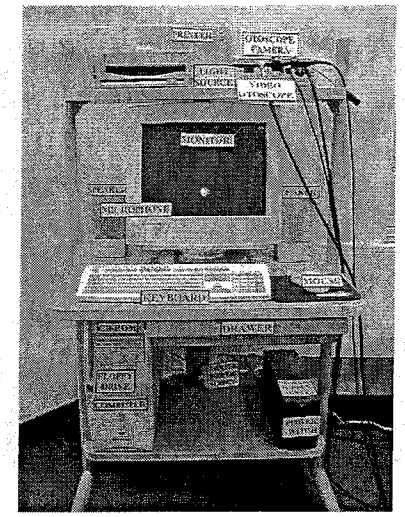
ATTP Workstation



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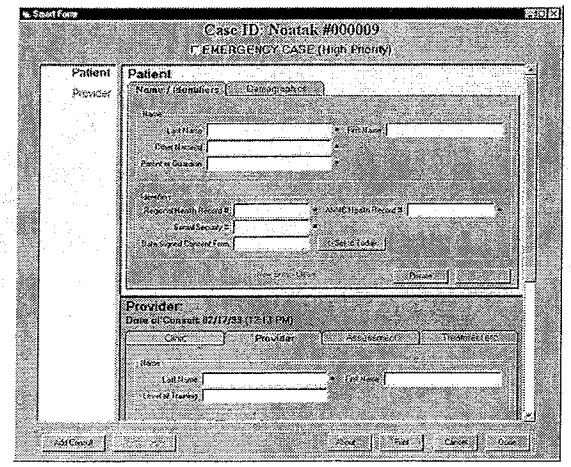
ATTP Software



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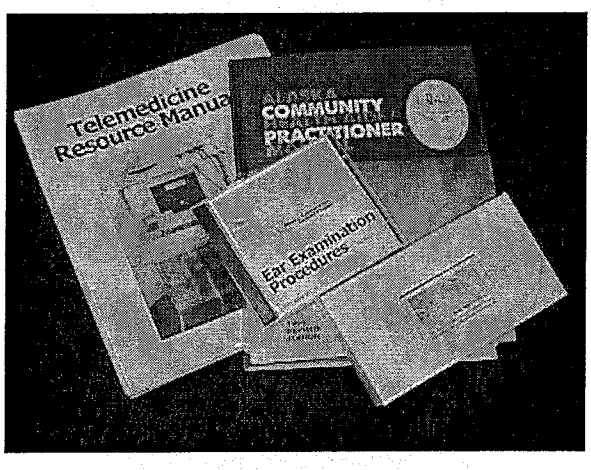
ALASKA TELEMEDICINE PROJECT

Training Materials



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Training

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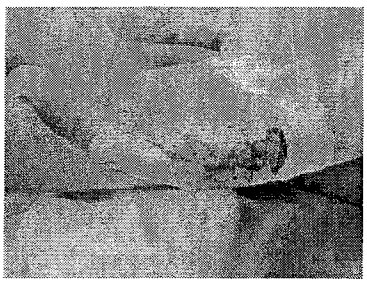

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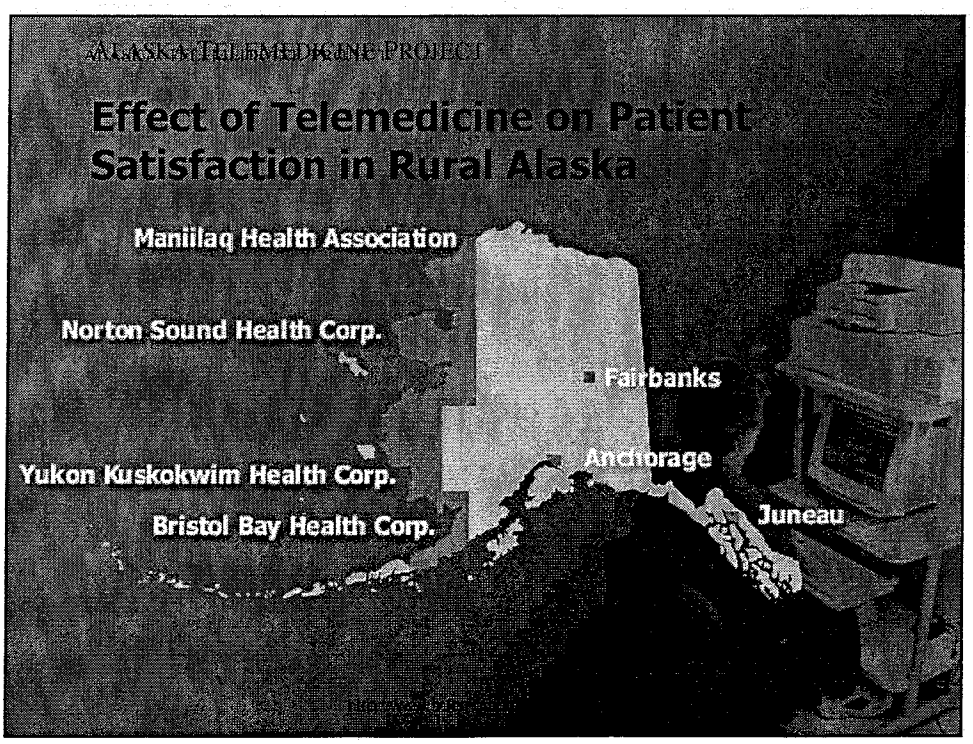

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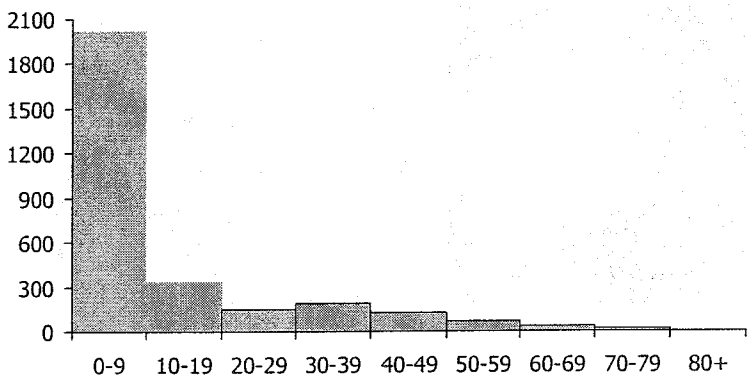
Age of Patient



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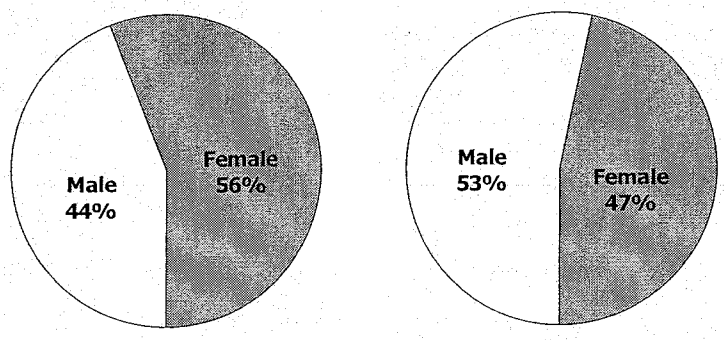
Gender



by Patient
1998 Surveys

by Population
1990 Census

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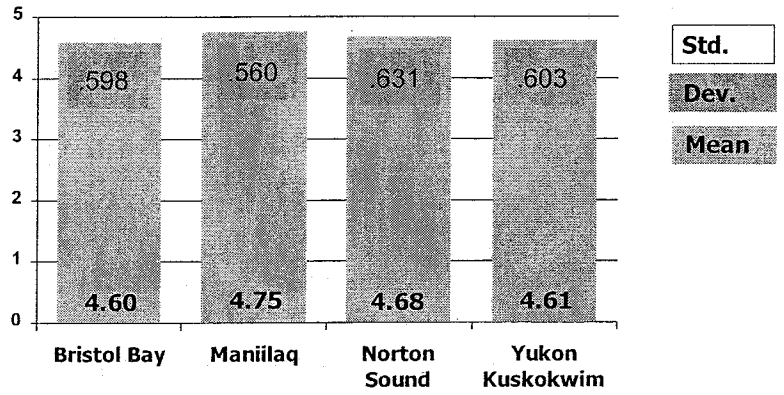
Average Patient Satisfaction Level (Before Telemedicine)



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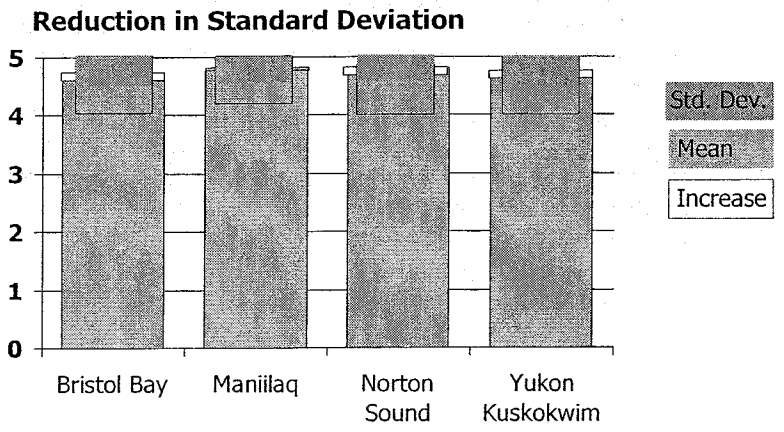
Patient Satisfaction (After Telemedicine)



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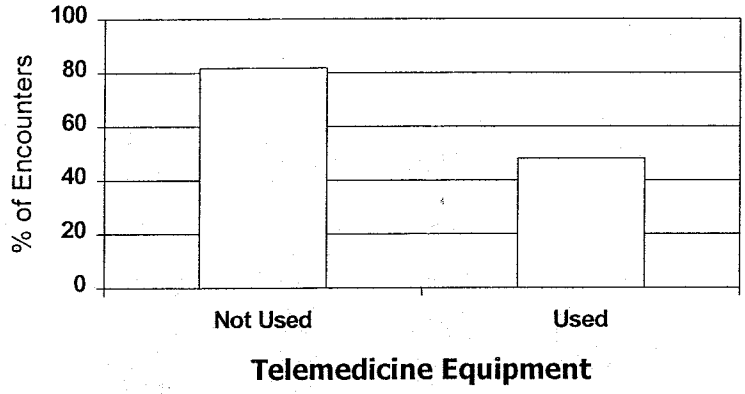
ALASKA TELEMEDICINE PROJECT

Encounters in Which Antibiotics were Dispensed



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ALASKA TELEMEDICINE PROJECT

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ALASKA TELEMEDICINE PROJECT

Benefits Analysis

- In this rural Alaska managed care case, the technological innovation increases the value of the provided service and reduces the value of the rationed service.
- Introduction of telemedicine reduces the patient's average loss from service rationing from $54 to $29 per visit.

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ALASKA TELEMEDICINE PROJECT

Estimated "value-added" of telemedicine (N = 497)

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- two models incorporating travel cost and health care rationing in rural Alaska
- value per event is $25 (this is the increased value of the health aide visit to the patient when telemedicine is used)

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Cost Analysis

- Telemedicine Cost Analysis assumptions
  - health care service must be "as good or better" than current service based on transportation
  - ENT services may be cost justified against transportation costs
  - total "cost per transaction" must be "less than" HCFA reimbursement schedule for specific clinical specialty

Cost Analysis

- Cost benefit assumptions:
  - "sustainability" is the ability for the Native Health Corporation to pay for the healthcare service
  - in rural Alaska you can't "make up the difference in volume"
  - health care service must be "as good of better" than current service based on transportation
  - ENT services may be cost justified against transportation costs
  - cost benefit must be viewed in terms of the "cost per transaction"

ALASKA TELEMEDICINE PROJECT

Findings and Discussion

- More than 9,800 ENT clinical events logged
- ATTP system designed for ENT; used for ENT, Dermatology, EM
- Patients' and Providers' "satisfaction" related to training and support
- Provider "survival" data suggests that telemedicine and telehealth applications do not increase the length of stay of healthcare providers in rural Alaska

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ALASKA TELEMEDICINE PROJECT

Findings and Discussion

- Cost analysis is being conducted with data from all four Alaska Native Health Corporations four years after implementation
- The Alaska Telemedicine Testbed Project is concluding a one-year continuation of funding from the National Library of Medicine to implement seven additional systems in private clinics in "rural Alaska" serving non-Native and Native populations

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Preliminary Conclusions

- Rural health care providers, especially the Community Health Aides, "love" the ATTP system and "don't know how they were able to do their jobs before the telemedicine system"
- As the result of the Alaska Telemedicine Testbed Project, Alaska's Congressional delegation has designated funding through IHS, VA, DOD, and DOT appropriations to deploy the ATTP system to all 235 villages and communities in rural Alaska

Alaska Telemedicine Testbed Project

ATA 2001

6th Annual Meeting & Exposition
of the American Telemedicine Association
June 5, 2001

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Matt Berman, Ph.D.	ATTP Cost & Benefits Study
Denise Statz, PA-C	ANHB Project Manager
Stewart Ferguson, Ph.D.	ANHB Dir. of Technology
Heidi Hammond	Training Materials Producer
Destyne Taft Greg Storey	Presentation Designer

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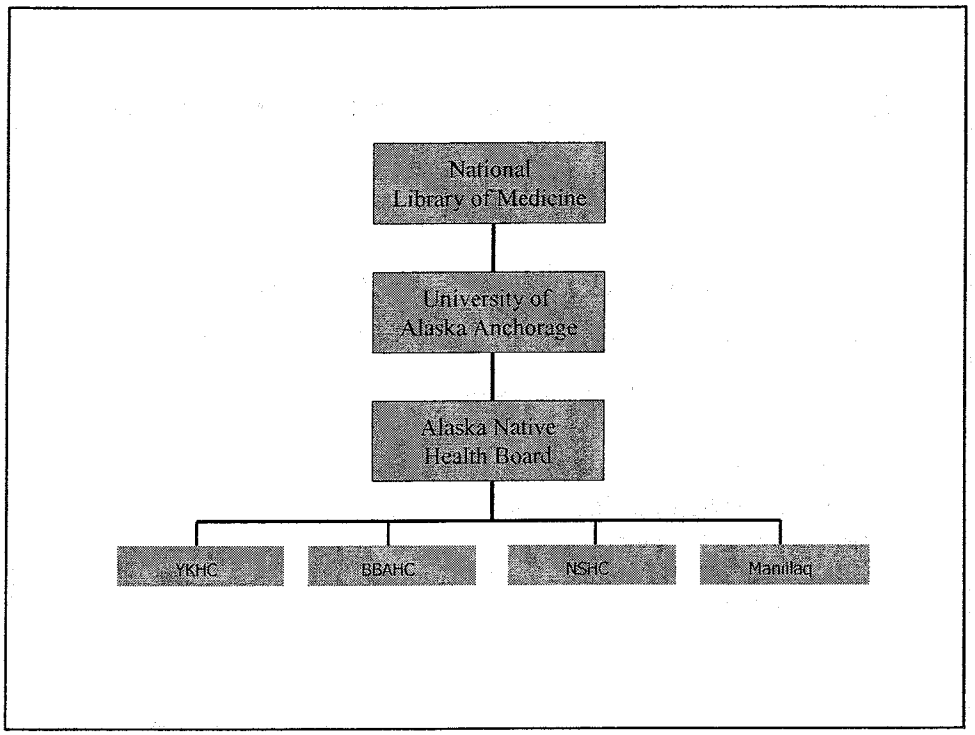


Basic Research Model

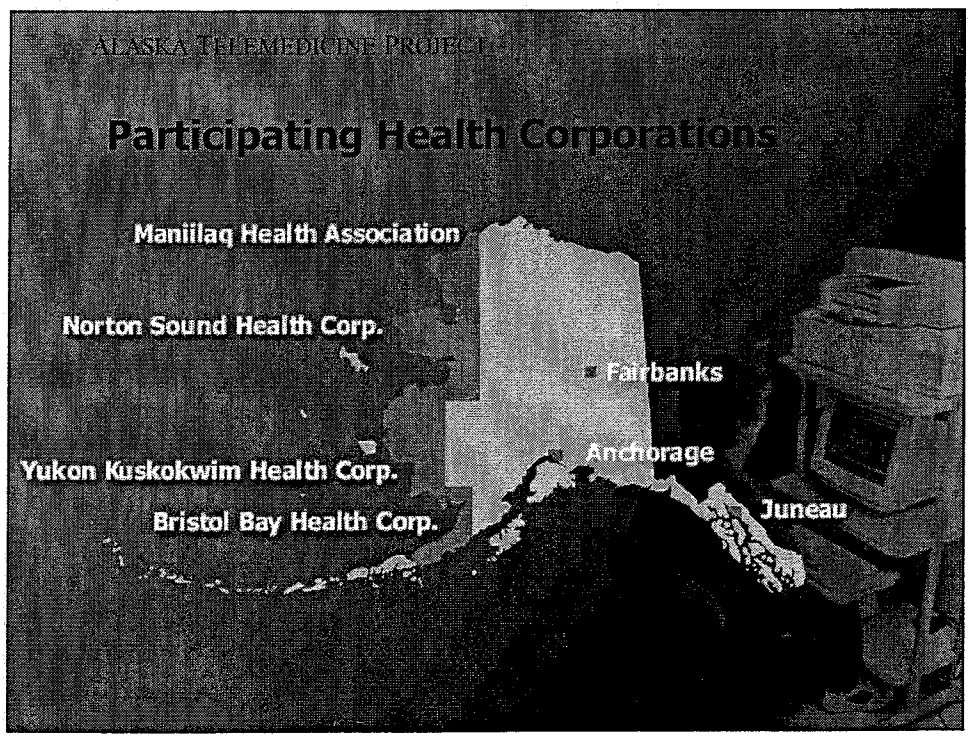
* Alaska data are being compared to 1996 transportation records for IHS and Providence Health Systems in Alaska; data analysis revealed 90,000 air transports from rural Alaska to Anchorage in five clinics: emergency medicine; OBG/YN; dentistry, dermatology; ENT

* ENT was chosen as clinical focus of study because of the 4,500 transports for ENT; the statistical significance of ENT across the regions (no gender or age bias); and because of the severity of otitis media in rural Alaska

10.300

Basic Research Model

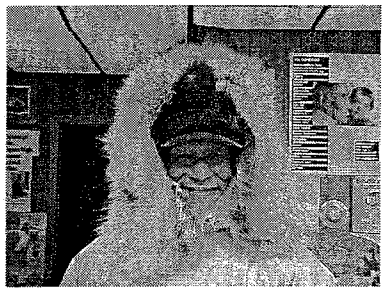
* The experimental design: interrupted time series model; villages and regions are compared to themselves in pre-and post-intervention model
* Data collection: retention data have been collected and processed; satisfaction data has been collected since Feb. 16, 1997 and continues; antibiotics data collection is completed, cost and benefit data has been requested from participating Alaska Native health corporations
* The methods of analysis: based on power calculations; SAS analysis.



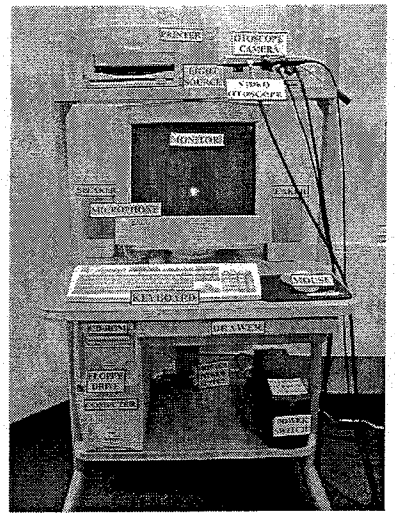
10.301

Work Session December 1998

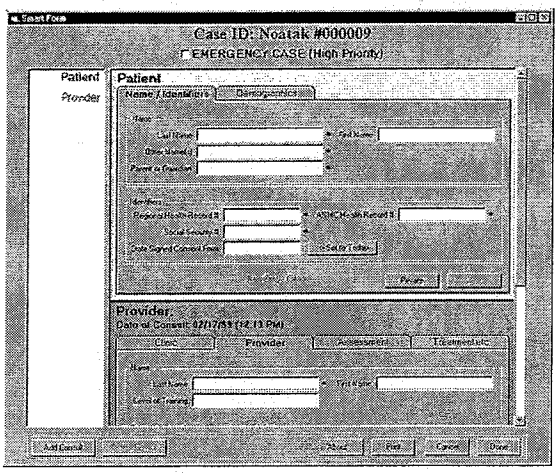
Deployment



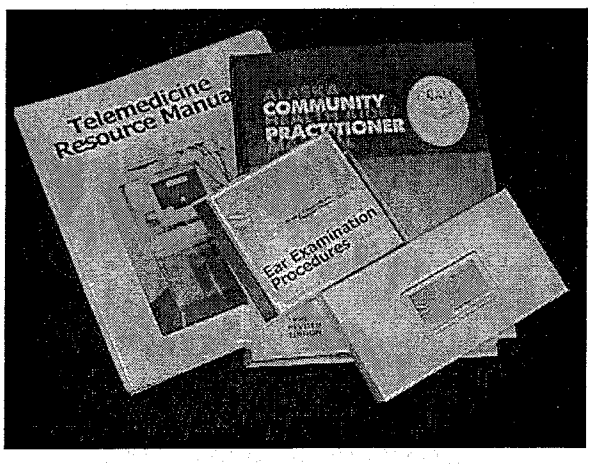
ATTP Workstation



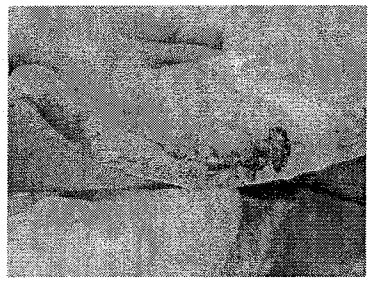
ATTP Software

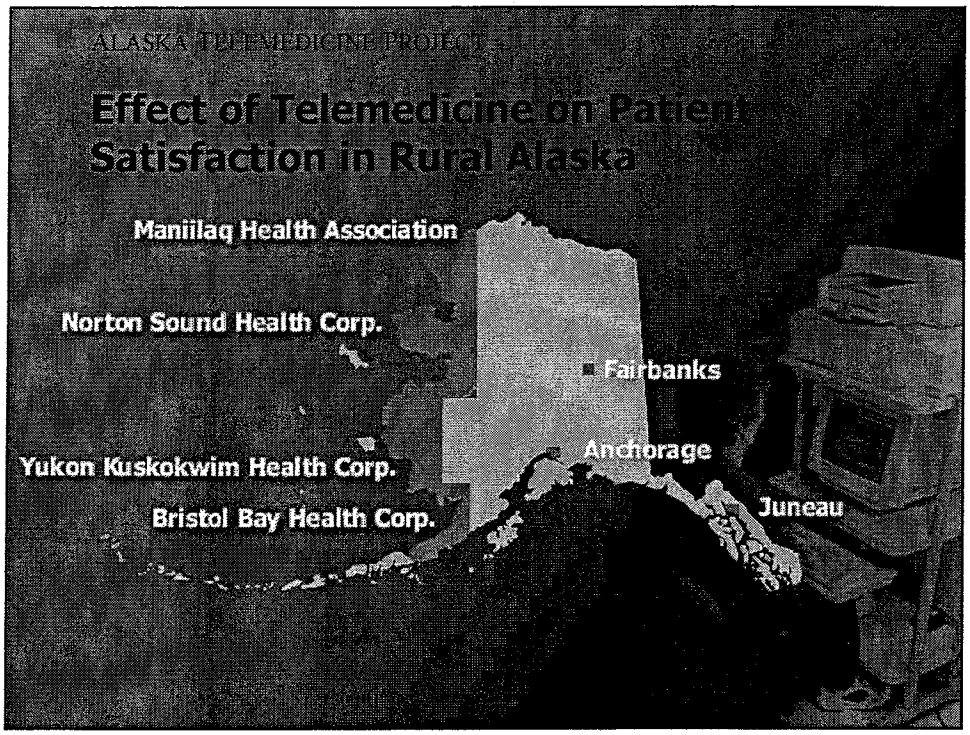


Training Materials



Training



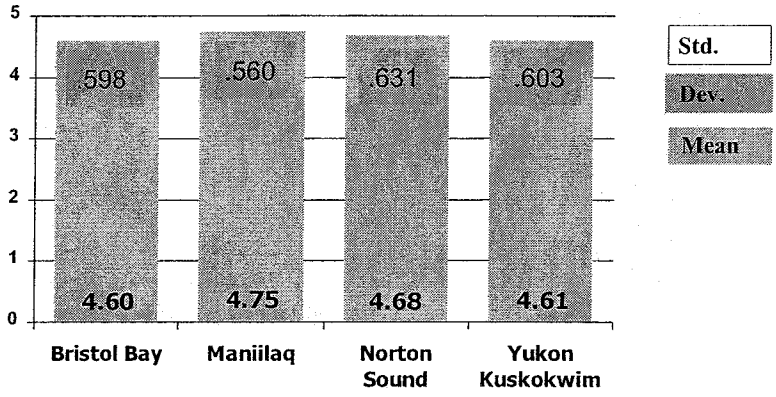


Hypothesis

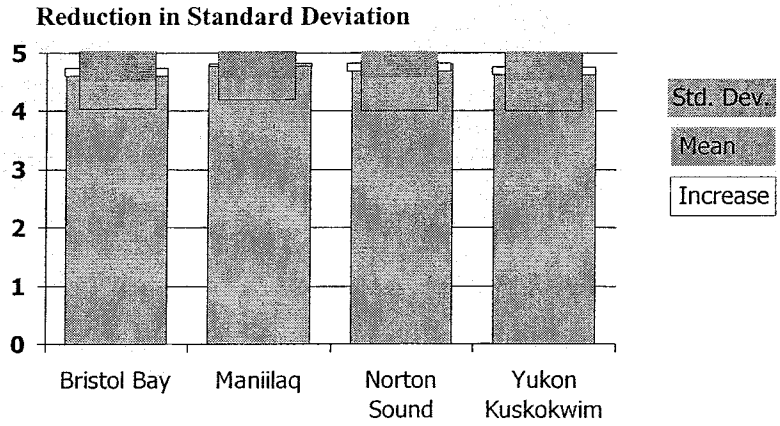
- Will effectively designed, deployed, and supported telemedicine and telehealth applications increase the patients' overall "satisfaction" of healthcare?

10.306

Average Patient Satisfaction Level (Before Telemedicine)

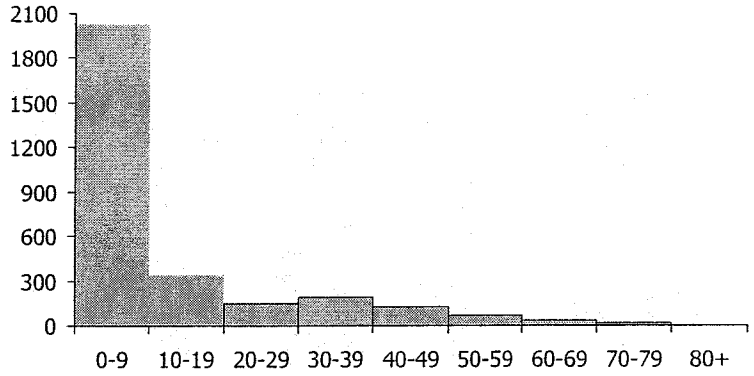


Patient Satisfaction (After Telemedicine)

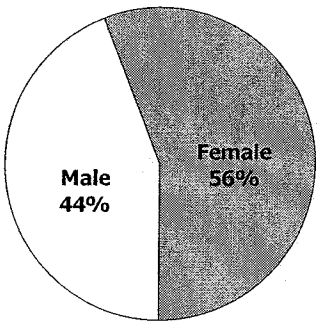


10.307

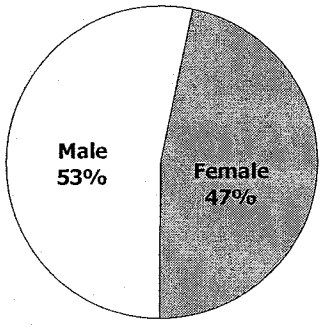
Age of Patient



Gender



by Patient
1998 Surveys



by Population
1990 Census

Overall Patient Satisfaction Model for Maniilaq Health Corporation

$$y = 0.14 + 0.15sex + 0.28Q_2 + 0.19Q_3 + 0.40Q_4 + -0.13\ Q_2\ sex$$

p-value = 0.00470.0405 <.0001 <.0001 <.0001 0.0047

Q_2 = I am satisfied with the amount of time the Provider spent with me

Q_3 = The Provider understood my needs and concerns

Q_4 = I am satisfied with the treatment provided for my health problem.

Hypothesis

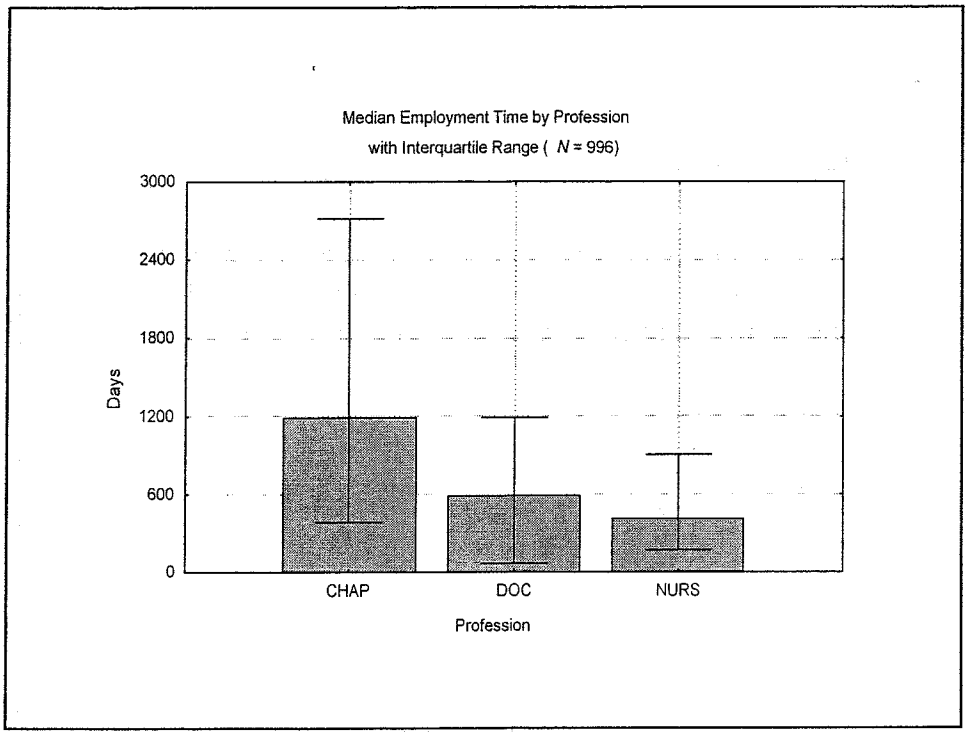
- Will the implementation of effectively designed, deployed and supported telemedicine and telehealth applications significantly increase the employment retention of healthcare providers in rural Alaska?

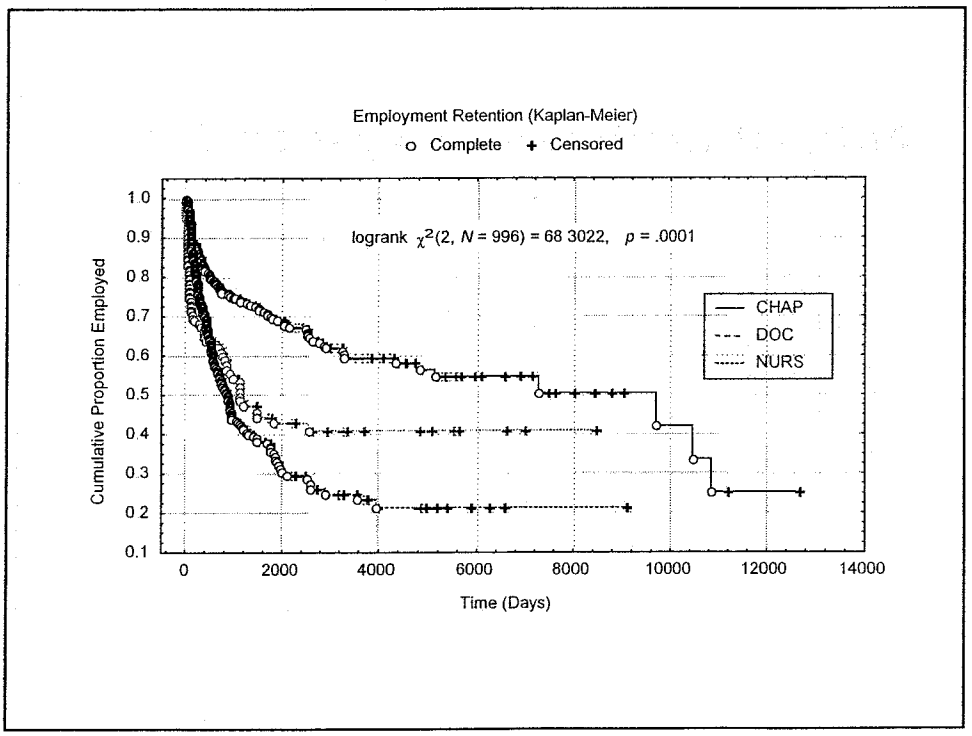
Methods

- Obtain data files from each region that includes: hire date, termination date, and position title for all doctors, nurses, and health aides.
- Compare Kaplan-Meier product limit survival curves of employment length before versus after telemedicine implementation.

Findings

- 57% of data points are censored (that is, employees had not been terminated by the time of data file construction).


Median Employment Time by Profession
with Interquartile Range (N = 996)
3000
2400
1800
1200
600
0
Days
CHAP
DOC
NURS
Profession

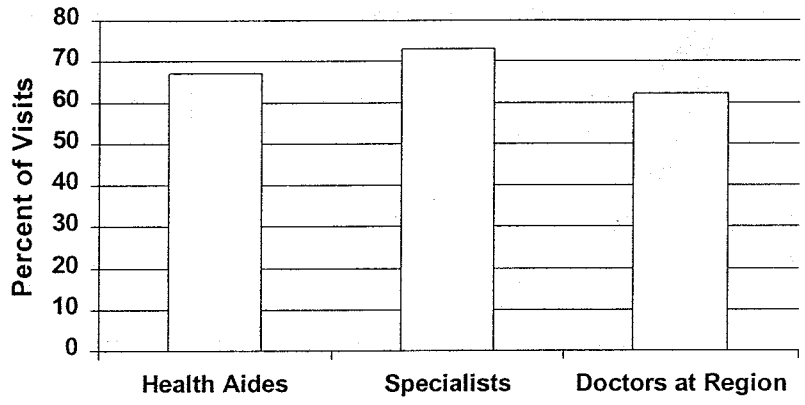

Employment Retention (Kaplan-Meier)
o Complete + Censored
logrank χ²(2, N = 996) = 68 3022, p = .0001
CHAP
DOC
NURS
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
Cumulative Proportion Employed
0
2000
4000
6000
8000
10000
12000
14000
Time (Days)

10.311

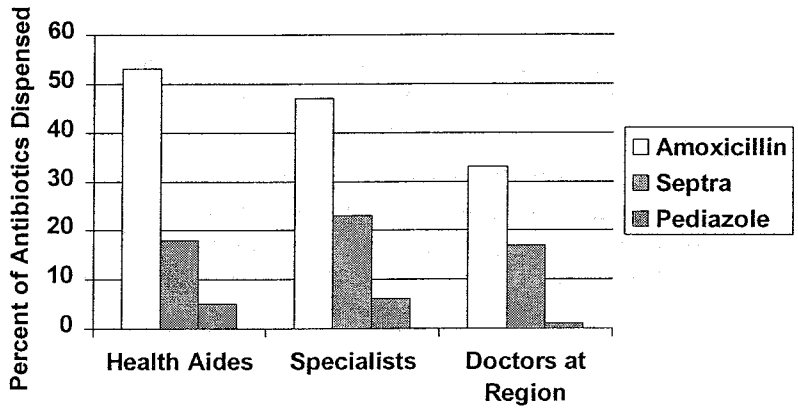
Hypothesis

- Will the implementation of effectively designed, deployed and supported telemedicine and telehealth applications significantly affect the antibiotic use in rural Alaska?

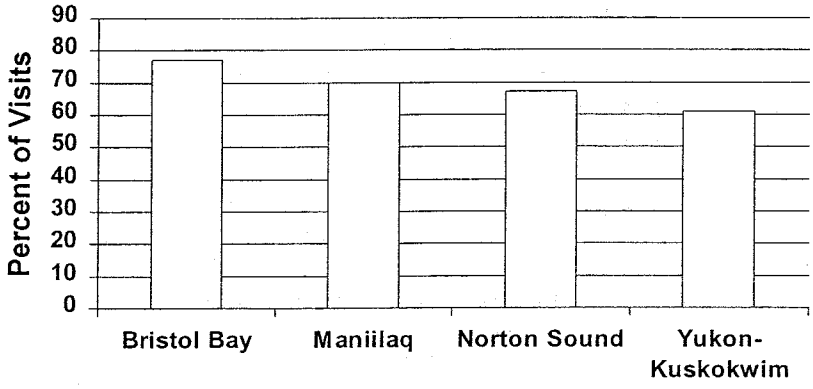
Antibiotics Dispensed by Provider



Top 3 Antibiotics Dispensed by Provider



Antibiotics Dispensed, by Region (Health Aides only)

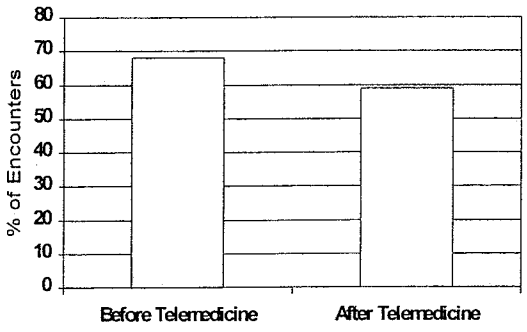


χ^2 (3, n = 2908) = 29.7, p < .001

Antimicrobial overprescription contributes to bacterial resistance

* The diagnosis of otitis media accounts for a large proportion of antibiotic prescription, particularly among young children
* Consultation with ENT specialists via telemedicine equipment may result in more judicious dispensation of antibiotics by village health aides

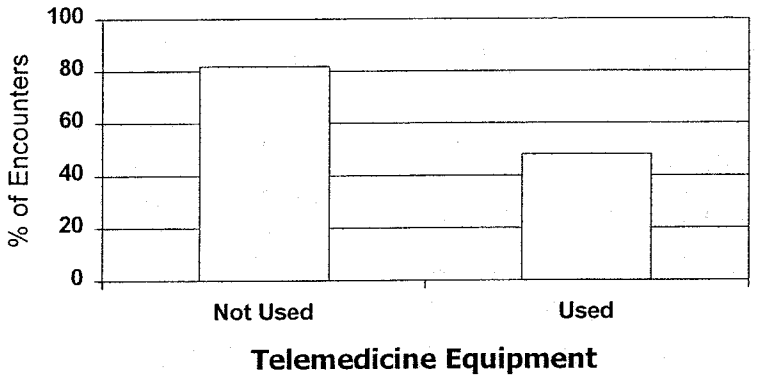
% of Encounters in Which Antibiotics were Dispensed



$\chi^2(1, \underline{n} = 4039) = 20.34, \underline{p} < .001$

- Hypothesis
- After implementation of telemedicine equipment, is there an association between *use* of the equipment and antibiotic dispensation by village health aides?

% of Encounters in Which Antibiotics were Dispensed



$\chi^2(1, \underline{n} = 507) = 60.44, \underline{p} < .001$

- Does the association between use of telemedicine and antibiotic dispensation hold after controlling for potential confounders?
  - –Severity of the case
  - –Age of the patient

Logistic Regression Model Predicting Dispensation of Antibiotics by Health Aides

Variable	OR	LCL UCL
Gender	1.30	0.87, 1.98
Age (5 yrs)	0.99	0.89, 0.99
Orders	2.12	1.34, 3.35
Sent to Region	0.28	0.11, 0.70
No Telemed	**6.22**	**3.92, 9.87**

$\chi^2(8) = 9.31$, $p = .32$

10.316

Conclusions

- Deployment and use of ENT-related telemedicine equipment is associated with a decrease in the dispensation of antibiotics by village health aides, even when controlling for potential confounders.

Hypothesis

- Will the implementation of an effectively designed and implemented telemedicine system increase the "benefit" of health care delivery in rural Alaska?

Benefits Analysis

- Telemedicine Benefits assumptions
  - health care service must be "as good or better" than current service based on transportation
  - ENT services may be cost justified against transportation costs
  - benefits must be viewed in terms of the "cost per transaction"

Benefits Analysis

- Rural health providers have looked to telemedicine as a technology to reduce costs. However, virtual access to physicians and specialists may alter patients' demand for face-to-face physician access.
- We develop a model of service demand under managed care, and apply the model to a telemedicine application in rural Alaska. Provider-imposed delays and patient costs were highly significant predictors of patient contingent choices in a survey of ENT clinic patients.
- The results suggest that telemedicine reduced the mean patient loss from rationing of physician access by 46 percent, or about $25 per visit.

Benefits Analysis

- estimate that a telemedicine innovation increased estimated patient benefits by about 20 percent, and reduced the estimated loss from rationing of access to physicians by 46 percent.

Benefits Analysis

- In this rural Alaska managed care case, the technological innovation increases the value of the provided service and reduces the value of the rationed service.
- Introduction of telemedicine reduces the patient's average loss from service rationing from $54 to $29 per visit.

Estimated "value-added" of telemedicine (N = 497)

- value to patient (parent's of patient)
- two models incorporating travel cost and health care rationing in rural Alaska
- value per event is $25 (this is the increased value of the health aide visit to the patient when telemedicine is used)

Hypothesis

- Will the implementation of effectively designed, deployed and supported telemedicine and telehealth applications be cost effective given rural Alaska's great distances, low population density, "third world" telecommunications infrastructure, and current "transportation-based" system of healthcare delivery?

10.320

Cost Analysis

- Cost benefit assumptions:
  - "sustainability" is the ability for the Native Health Corporation to pay for the healthcare service
  - in rural Alaska you can't "make up the difference in volume"
  - health care service must be "as good of better" than current service based on transportation
  - ENT services may be cost justified against transportation costs
  - cost benefit must be viewed in terms of the "cost per transaction"

Findings and Discussion

- More than 1,800 ENT clinical events logged
- ATTP system designed for ENT; used for ENT, Dermatology, EM
- Patients' and Providers' "satisfaction" related to training and support
- Provider "survival" data suggests that telemedicine and telehealth applications do not increase the length of stay of healthcare providers in rural Alaska

Findings and Discussion

- Cost benefit analysis is being conducted with data from all four Alaska Native Health Corporations one year and three years after implementation
- The Alaska Telemedicine Testbed Project is completing a one-year continuation of funding from the National Library of Medicine to complete Cost benefit analysis; to deploy seven systems in private clinics in "frontier Alaska" serving Native and non-Native populations; and to conduct a qualitative study concerning training and support.

Preliminary Conclusions

- Rural health care providers, especially the Community Health Aides, "love" the ATTP system and "don't know how they were able to do their jobs before the telemedicine system"
- As the result of the Alaska Telemedicine Testbed Project, Alaska's Congressional delegation has designated funding through IHS, VA, DOD, and DOT appropriations to deploy the ATTP system to all 235 villages and communities in rural Alaska

Successful Solutions to Information Flow and User Interface Issues Affecting Telemedicine in Alaska

Alaska Native Health Board
A. Stewart Ferguson, Ph.D.
Denise Statz, P.A.
Rob Rawls

University of Alaska Anchorage
Frederick W. Pearce, Ph.D.
Heidi Hammond

Alaska Telemedicine Testbed Project

- Funded by NLM Contract #N01-LM-6-3540
- University of Alaska Anchorage (UAA)
- Alaska Native Health Board (ANHB)
- 4 Regional Health Corporations

10,323

ATTP - An Evaluation Study

- **Cost and Benefits Model**
  - **Focus on cost recovery from transportation and training budgets**
- **Satisfaction Model:**
  - **Satisfaction "as good or better than" current "transportation-based model" for village providers, consulting physicians, and patients**
- **Survival Analysis Model:**
  - **Cost of isolation and turnover among health care providers in Alaska**

ATTP - Methods

- Ear Disease selected as relevant clinical issue
- Evaluation conducted "pre/post" telemedicine installation
- 1 Tertiary care facility (ANMC)
- 4 Regional facilities
- 26 Village clinics

Map (or maps) goes here -

- Anchorage (ANMC)
- Kotzebue (MHC)
- Dillingham (BBAHC)
- Nome (NSHC)
- Bethel (YKHC)

Alaska' Tribal Health System

- All facilities owned and operated
- Tertiary Care Facility - ANMC
- 7 "Bush" hospitals
- 184 Village health clinics

Alaska Native Medical Center (Anchorage)

- Opened in 1998
- 380,000 ft^2
- 150 beds
- 89 physician staff

Maniilaq Health Center (Kotzebue)

- Opened in 1995
- 80,000 ft^2
- 17 beds
- 8 physicians, 2 PA, 1 NP

Village Clinic (Noatak)

- Opened in 1950
- 600 ft^2
- 0 beds
- 4 CHPs

PROBLEM #1
Regional Differences

Information Systems

- ANMC
  - HIS based on RPMS
  - Email based on Exchange 5.0
- 4 Regional Health Corporations
  - HIS based on RPMS and Meditech
  - Email based on:
    - Exchange 5.0, 5.5
    - Meditech POP
    - FCIS v5.5 (POP)

Referral Pattern

- Picture showing village to region connectivity, and region to ANMC. Show Service Units or regional health corps.

Information Systems

- Must work with existing "server" structure at regions
- Must provide future migration path to various existing HIS
- Must work with various OS - Win95, Win98, WinNT
- Must work on various CPUs

PROBLEM #2
Telecommunications

Telecommunications

- External connectivity (to "Outside") very good.
- Internal connectivity (to "bush") very poor.
- Rapidly changing (over 100 licensed LDCs)
- Only place in world where AT&T uses satellites for voice communications
- T1 Anchorage to Region - $12,000/month
- 128K (to village) - $2,000 to $3,000/month

Satellite Communications

- Geosynchronous - 22,500 miles (260 msec delay per hop)
- Billing centralized in Anchorage
- Limited switching circuitry outside Anchorage
- Old analog technology slowly being replaced by newer digital technology (get #s from AT&T and GCI)

Analog Technology

- Relies on double satellite hops
  - 520 msec delays single direction
  - 1040 msec delay bidirectional
  - Companding, reduces 4000 Hz bandwidth to 3200 Hz, causing V.32 and V.34 stepdowns.
  - Theoretical limit is 14.4 kbps
  - S/N reduces to 4800 bps
- 1/3 state sites are analog - but most of these need telemedicine

Digital Technology (DAMA)

- Demand Assigned Multiple Access
- Longer call setup times
- Fast busy when # calls > #channels
- AT&T - limited to 14.4 kbps due to A/D converted
- GCI - typically 28.8 kbps - can ramp to 768 kbps
- PAMA - "Permanent AMA"

Connectivity

- Pots/WAN based
- Must work at 2400 bps
  - Store and Forward - No live video
  - Small image size:
    - 640x480 24 bit color = 900 KB (62 min)
    - Compress 50:1 = 18 KB (77 sec)
    - good compression engine
- Must work with "dropped lines

PROBLEM #3
Clinic Design

Clinic Design

- Most clinics have 1 or 2 exam rooms
- Exam may occur in other areas - e.g. office
- Power, telephone and network outlets often unavailable in exam areas
- Clinics are very busy locations

Telemedicine Cart

- Picture of cart
- 24" and 30"
- Dust - bedsheets
- Height constraints
- Width constraints - doorways

10333

CPU

- Generic CPU (Dell, Gateway, Micron)
- Integral Technologies FlashBus MV PRO frame grabber
- Matrox Millenium G200 AGP graphics card
- USR V.Everything 56K modem
- 17" monitor, color calibrated
- UPS, printer, speakers

Installation

- Moveable - multiple room clinics
- High school students provide installation
- Assembly at clinic - flown in small airplanes, hauled in sleds. Small boxes.
- Expensive (>$700) flights to maintain equipment
- Weather delays

10.334

PROBLEM #4
Ear Disease

Video Otoscope

- Resolution
- Depth of focus, angle of view
- Distortion, illumination
- Ease of use
- Ease (and accuracy) of white balance
- Multiuse (ENT vs "E")
- (picture of sample output, report)

Otoscope

- 2.5mm specula for children
- Pneumatic otoscopy
- Reinforced webbing around cables
- Otoscope hook
- Positioned high on cart
- (Picture of WA equipment)

PROBLEM #5
End User

Community Health Aide / Practitioner (CHA/P)

- Minimum requirement - 6th grade reading and writing level
- CHA Session I, II, III, IV
- CHP
- (Picture of CHAM)

End User

- 26 of 31 sites are village clinics
- Train >100 CHAPs to use equipment - most with little (or no) computer literacy
- Physical size limitations
- Adapt training procedures to CHAM
- Train CHAPS to maintain equipment
- Software review (show picture of report)

Client Software

- Windows NT workstation v4.0 SP4
- Microsoft Outlook 98
- Microsoft Outlook Forms
- MedVision Leverage2K
- Customized "Snapins"
- Local database, Printer templates

Medvision Leverage2K

- Provides a GUI interface for email attachments and Snapin technology
- Basic snapins support image capture, display, compression engine.

Customized "Snapins"

- MedVision provides a VB addon
- Written in VB6 - generate ActiveX Control
- Acquisition / Presentation pairs
- Currently have:
  - "Smart Form"
  - "Image Capture from Video Otoscope"
  - "Image Capture from Digital Camera"

Starting a New Case

- (Screen scrape with Outlook 98)

New Case -

- (Screen scrape of Insert Menu)

New Case

- (Screen Scrape of smart form - maybe put a couple in here. Also do Video Capture screen scrapes). Show Trigger in action. Show 5 keyhits / 1 mouse hit for Smart Form.

Displaying Cases

- (Screen scrape of a case- displaying images and annotation tools)

PROBLEM #6
Patient Population

10.341

Typical Patient

- COM accounts for 31% of visits to CHA of those under the age of 5
- Papoose board
- Remote trigger switch

Serial Trigger Device

- 4 buttons
- 2 lites
- ActiveX control
- Programmable:
  - Button functions
  - Help screen
  - Audible interface

10342

PROBLEM #7
Health Records

Outlook 98 Views

- User Defined fields from Smart Form - 7 case / 12 patient / 10 per consult
- Ordering by any field
- Customizable views based on fields
- Cascaded views
- Public Folders

Sample Views

- (screen scrape of view - maybe 2, showing cascaded)

Printing Cases

- (Screen Scrape of printed images)

PROBLEM #8
Knowledge Management

Knowledge Management

- Redefine roles, routes and rules for information flow within and between regions.
- Integrate to HIS - e.g. broker, ODBC, etc.
- What this means -
  - More snapins - more equipment
  - Server side scripting
  - Better understanding information flow

10.345

Server Software

- Prefer Microsoft Exchange v5.5
- Work with POP3 server using MIME encoding
- Option to use MSMQ as transport mechanism
- DUN or LAN
- Certificate Server - X.509 v3 certificates

Programming Interfaces

- Snapins - VB6 - ActiveX Control
- Outlook Forms - VBScript - 11 events
- Exchange Server v5.5 - VBScript -
- MSMQ layers
- Key: access to full Outlook model

Does It Work?

- 11 year old read training manual and complete case with no outside help.
- Elder woman, with documented 5th grade reading level, did same.
- Have installed software at 12 sites, upgraded 7, and now provide most training "over the phone".
- Number of cases: 200-300/month in Kotz.

Virtual Worlds and Simulation 2001

The Society for Computer Simulation International

Phoenix, Arizona

Jan. 9, 2001

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Dennis G. Fisher, Ph.D.	Director, ATTP Evaluation
Andrea Fenaughty, Ph.D.	ATTP Quality Control
Askar Choudhury, Ph.D.	ATTP Satisfaction Study
Matt Berman, Ph.D.	ATTP Cost & Benefits Study
Denise Statz, PA-C	ANHB Project Manager
Destyne Taft	Training Materials Producer
Greg Storey	Presentation Designer

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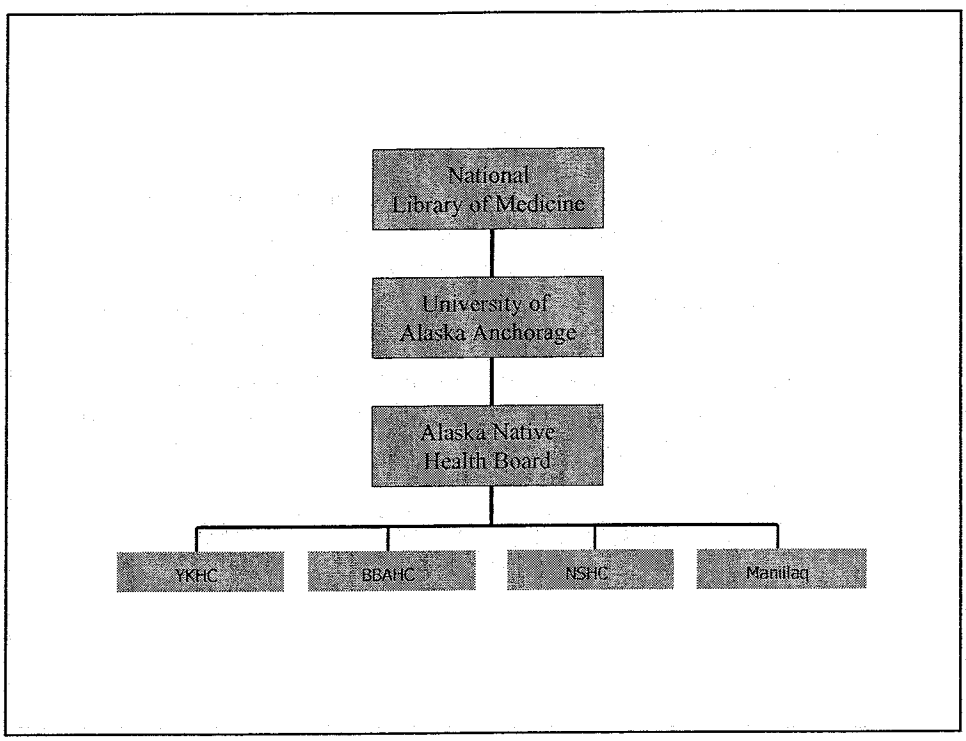

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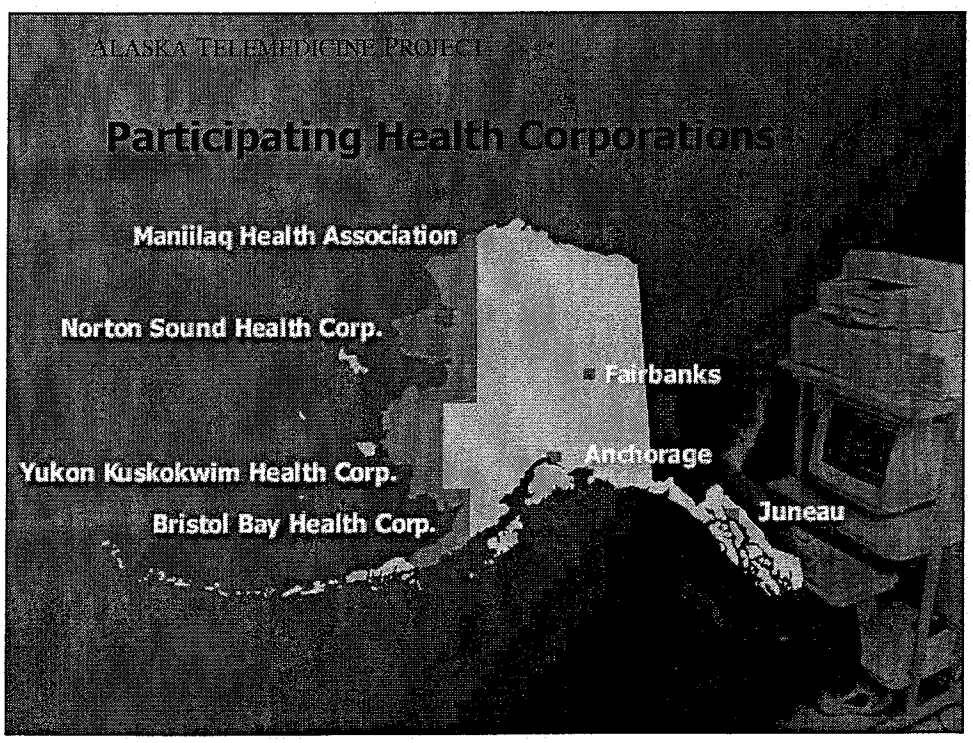

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Work Session December 1998

Deployment

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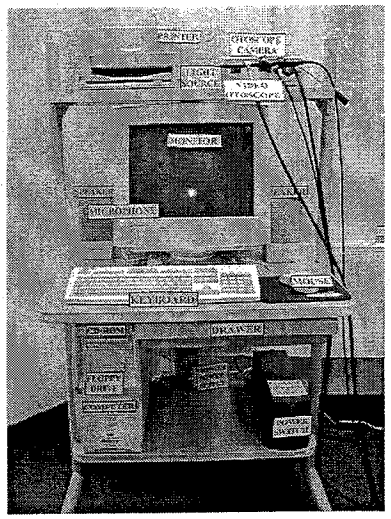
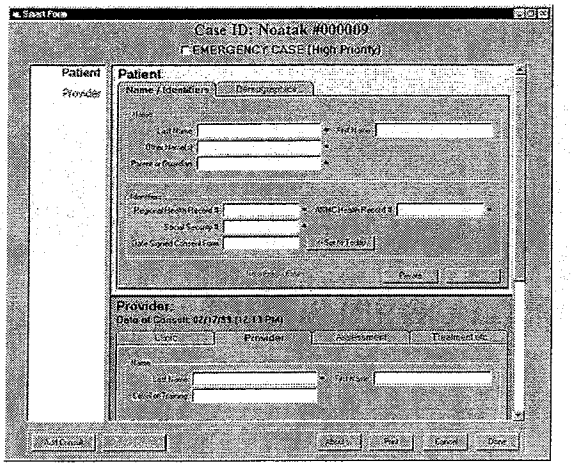
ATTP Workstation



ATTP Software



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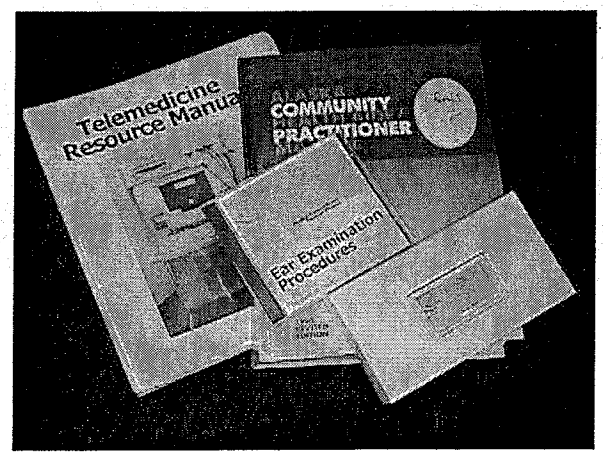
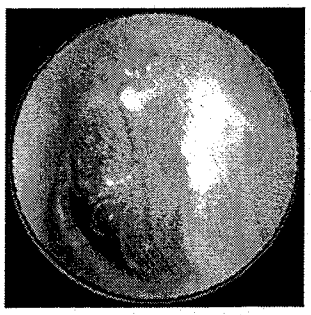
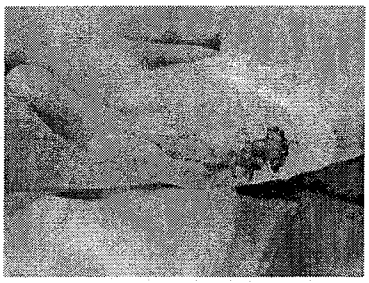
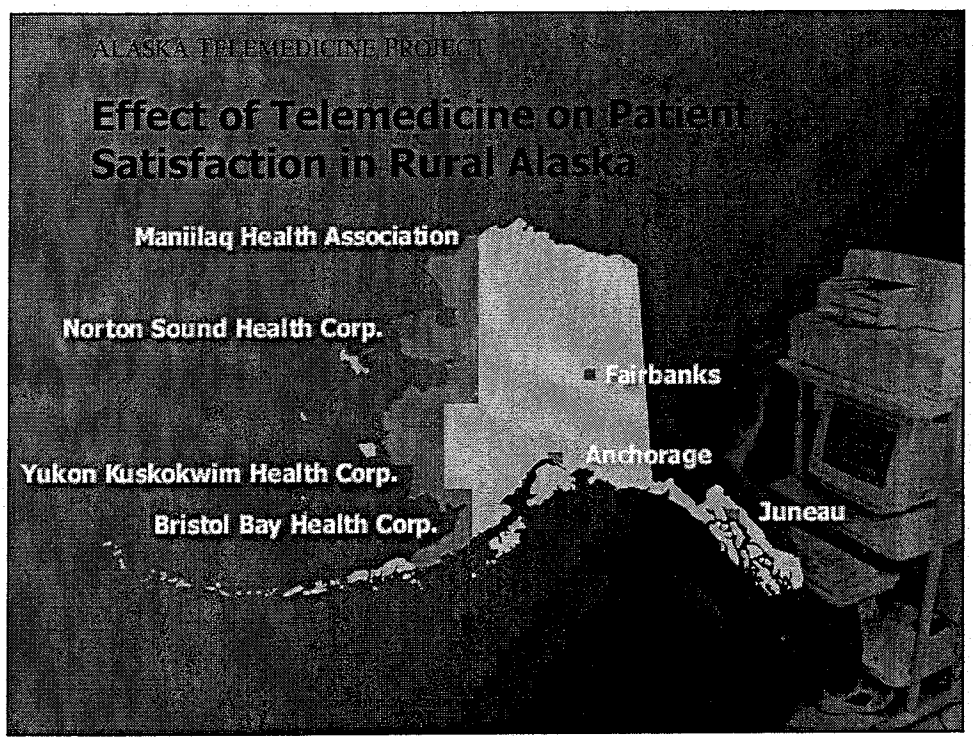


10.353

Training





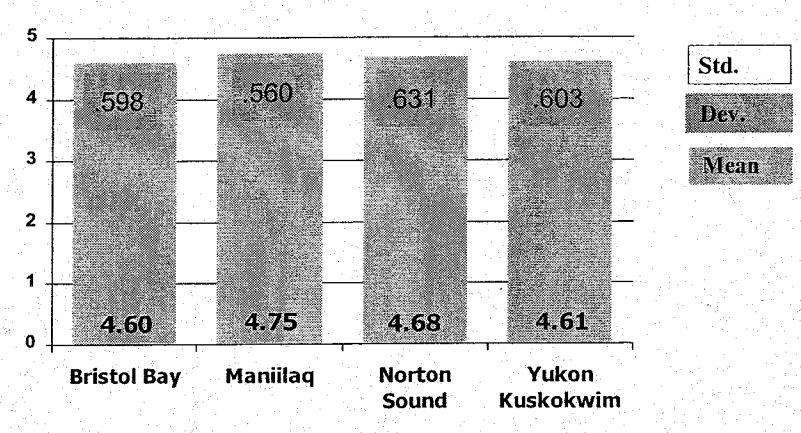


Hypothesis

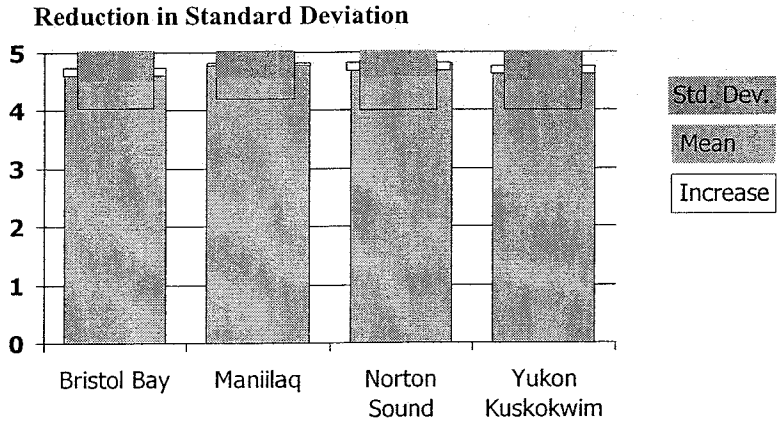
- Will effectively designed, deployed, and supported telemedicine and telehealth applications increase the patients' overall "satisfaction" of healthcare?

10.355

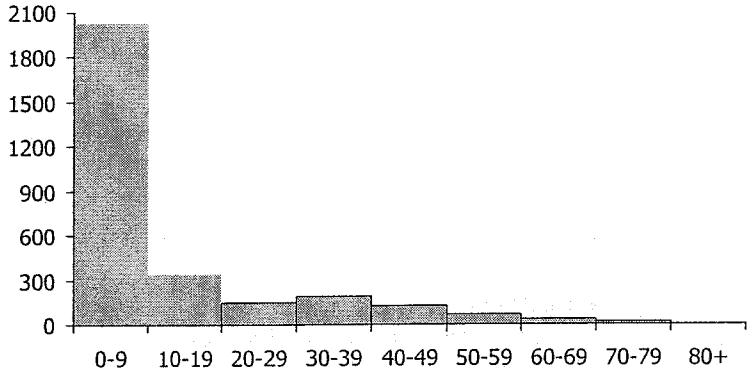
Average Patient Satisfaction Level (Before Telemedicine)



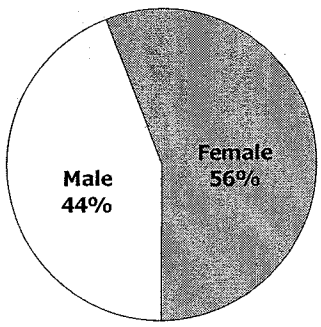
Patient Satisfaction (After Telemedicine)



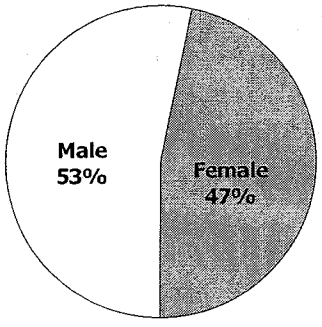
Age of Patient



Gender



by Patient
1998 Surveys



by Population
1990 Census

10357

Overall Patient Satisfaction Model for Maniilaq Health Corporation

$$y = 0.14 + 0.15sex + 0.28Q_2 + 0.19Q_3 + 0.40Q_4 + -0.13\ Q_2\ sex$$

p-value = 0.00470.0405 < 0001 <.0001 <.0001 0.0047

Q_2 = I am satisfied with the amount of time the Provider spent with me

Q_3 = The Provider understood my needs and concerns

Q_4 = I am satisfied with the treatment provided for my health problem.

Hypothesis

- Will the implementation of effectively designed, deployed and supported telemedicine and telehealth applications significantly increase the employment retention of healthcare providers in rural Alaska?

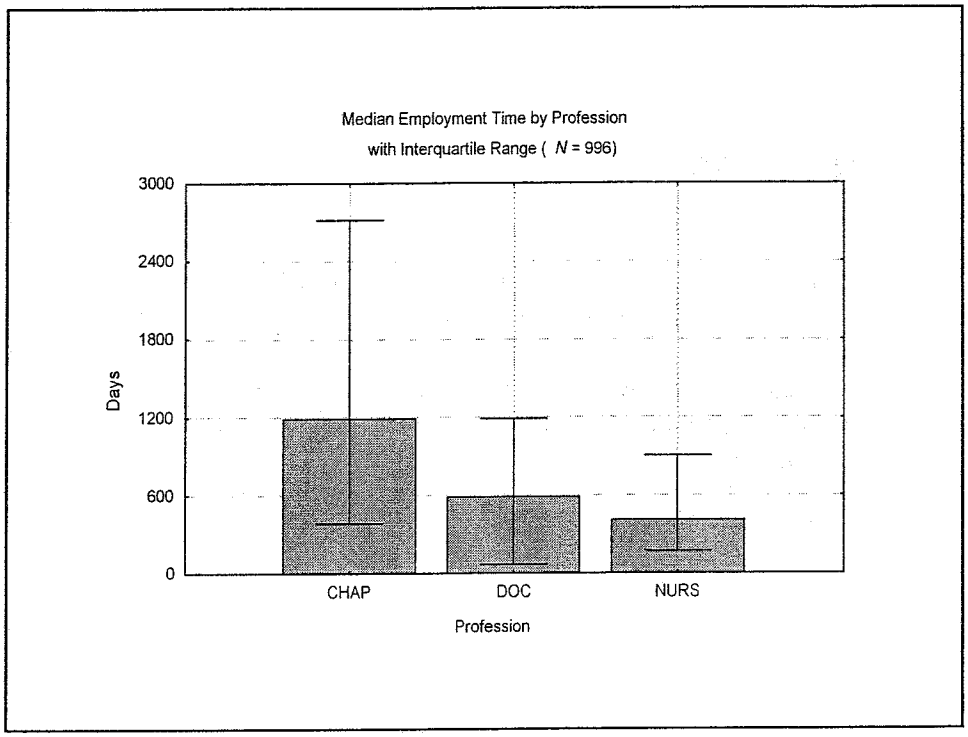
10.358

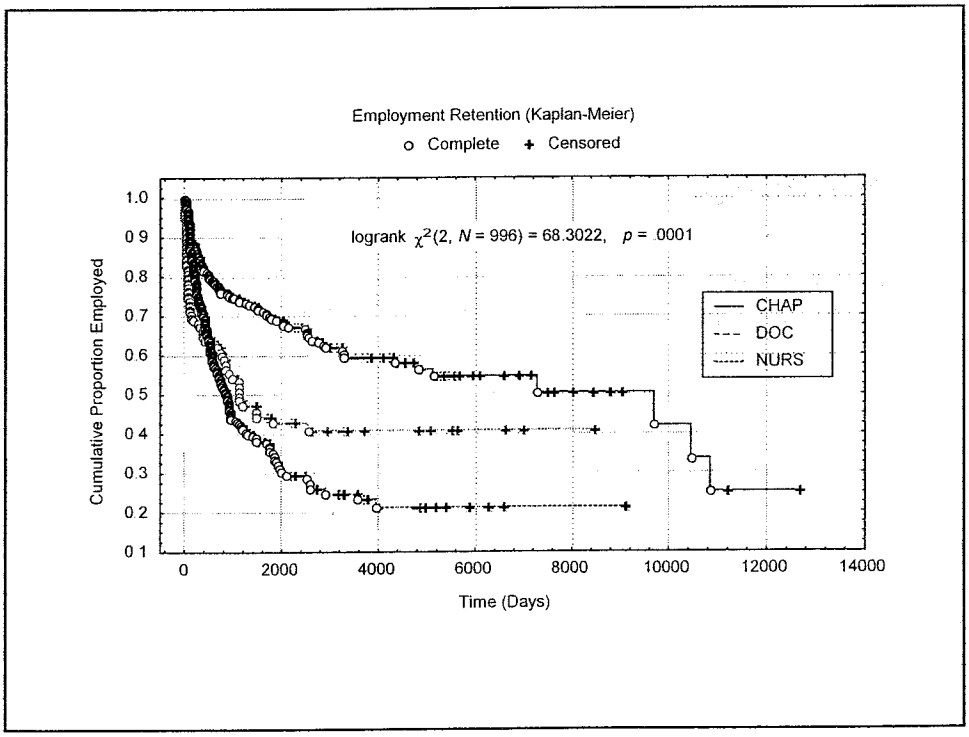
Methods

- Obtain data files from each region that includes: hire date, termination date, and position title for all doctors, nurses, and health aides.
- Compare Kaplan-Meier product limit survival curves of employment length before versus after telemedicine implementation.

Findings

- 57% of data points are censored (that is, employees had not been terminated by the time of data file construction).


Median Employment Time by Profession
with Interquartile Range (N = 996)
3000
2400
1800
1200
600
0
Days
CHAP
DOC
NURS
Profession

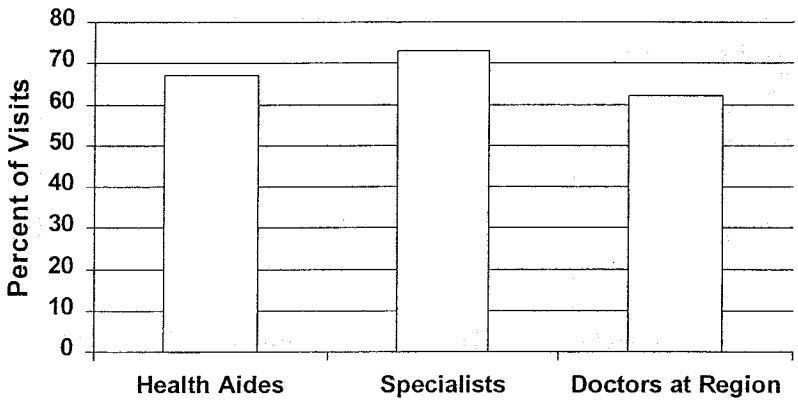

Employment Retention (Kaplan-Meier)
o Complete + Censored
logrank χ²(2, N = 996) = 68.3022, p = .0001
CHAP
DOC
NURS
Cumulative Proportion Employed
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
2000
4000
6000
8000
10000
12000
14000
Time (Days)

10.360

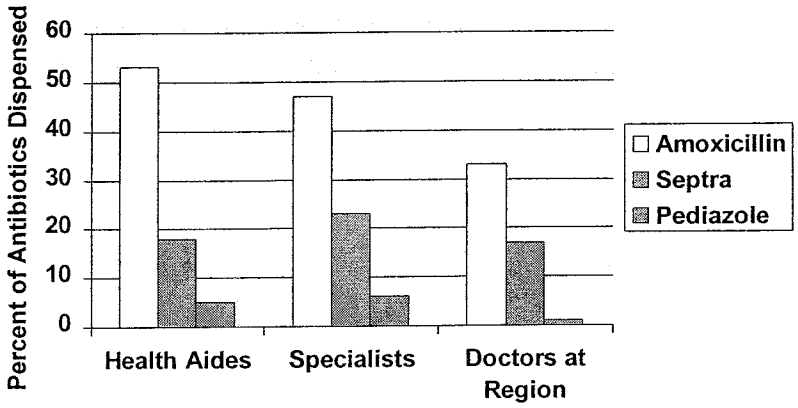
Hypothesis

- Will the implementation of effectively designed, deployed and supported telemedicine and telehealth applications significantly affect the antibiotic use in rural Alaska?

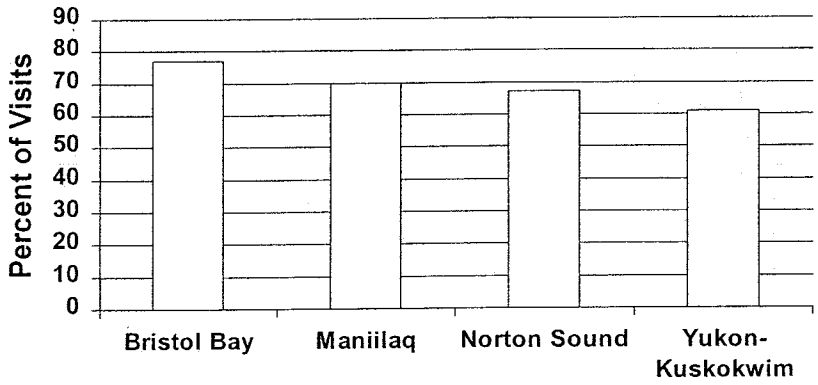
Antibiotics Dispensed by Provider



Top 3 Antibiotics Dispensed by Provider



Antibiotics Dispensed, by Region (Health Aides only)

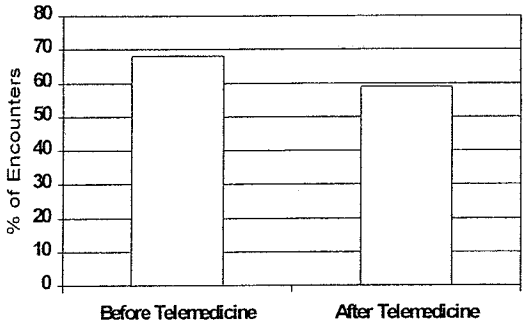


χ^2 (3, n = 2908) = 29.7, p < .001

Antimicrobial overprescription contributes to bacterial resistance

* The diagnosis of otitis media accounts for a large proportion of antibiotic prescription, particularly among young children
* Consultation with ENT specialists via telemedicine equipment may result in more judicious dispensation of antibiotics by village health aides

% of Encounters in Which Antibiotics were Dispensed

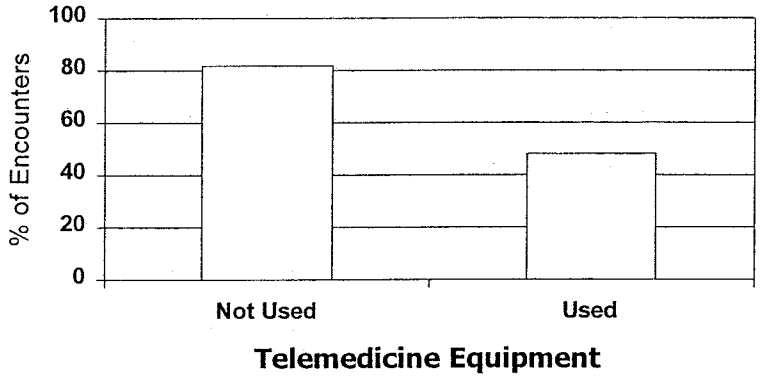


$\chi^2(1, \underline{n} = 4039) = 20.34, \underline{p} < .001$

10.363

- Hypothesis
- After implementation of telemedicine equipment, is there an association between *use* of the equipment and antibiotic dispensation by village health aides?

% of Encounters in Which Antibiotics were Dispensed



$\chi^2(1, \underline{n} = 507) = 60.44, \underline{p} < .001$

- Does the association between use of telemedicine and antibiotic dispensation hold after controlling for potential confounders?
  - –Severity of the case
  - –Age of the patient

Logistic Regression Model Predicting Dispensation of Antibiotics by Health Aides

Variable	OR	LCL UCL
Gender	1.30	0.87, 1.98
Age (5 yrs)	0.99	0.89, 0.99
Orders	2.12	1.34, 3.35
Sent to Region	0.28	0.11, 0.70
No Telemed	**6.22**	**3.92, 9.87**

$\chi^2(8) = 9.31$, $p = .32$

10.365

Conclusions

- Deployment and use of ENT-related telemedicine equipment is associated with a decrease in the dispensation of antibiotics by village health aides, even when controlling for potential confounders.

Hypothesis

- Will the implementation of an effectively designed and implemented telemedicine system increase the "benefit" of health care delivery in rural Alaska?

Benefits Analysis

- Telemedicine Benefits assumptions
  - health care service must be "as good or better" than current service based on transportation
  - ENT services may be cost justified against transportation costs
  - benefits must be viewed in terms of the "cost per transaction"

Benefits Analysis

- Rural health providers have looked to telemedicine as a technology to reduce costs. However, virtual access to physicians and specialists may alter patients' demand for face-to-face physician access.
- We develop a model of service demand under managed care, and apply the model to a telemedicine application in rural Alaska. Provider-imposed delays and patient costs were highly significant predictors of patient contingent choices in a survey of ENT clinic patients.
- The results suggest that telemedicine reduced the mean patient loss from rationing of physician access by 46 percent, or about $25 per visit.

Benefits Analysis

- estimate that a telemedicine innovation increased estimated patient benefits by about 20 percent, and reduced the estimated loss from rationing of access to physicians by 46 percent.

Benefits Analysis

- In this rural Alaska managed care case, the technological innovation increases the value of the provided service and reduces the value of the rationed service.
- Introduction of telemedicine reduces the patient's average loss from service rationing from $54 to $29 per visit.

Estimated "value-added" of telemedicine (N = 497)

- value to patient (parent's of patient)
- two models incorporating travel cost and health care rationing in rural Alaska
- value per event is $25 (this is the increased value of the health aide visit to the patient when telemedicine is used)

Hypothesis

- Will the implementation of effectively designed, deployed and supported telemedicine and telehealth applications be cost effective given rural Alaska's great distances, low population density, "third world" telecommunications infrastructure, and current "transportation-based" system of healthcare delivery?

Cost Analysis

- Cost benefit assumptions:
  - "sustainability" is the ability for the Native Health Corporation to pay for the healthcare service
  - in rural Alaska you can't "make up the difference in volume"
  - health care service must be "as good of better" than current service based on transportation
  - ENT services may be cost justified against transportation costs
  - cost benefit must be viewed in terms of the "cost per transaction"

Findings and Discussion

- More than 1,800 ENT clinical events logged
- ATTP system designed for ENT; used for ENT, Dermatology, EM
- Patients' and Providers' "satisfaction" related to training and support
- Provider "survival" data suggests that telemedicine and telehealth applications do not increase the length of stay of healthcare providers in rural Alaska

Findings and Discussion

- Cost benefit analysis needs to be conducted with data from all four Alaska Native Health Corporations one year and three years after implementation
- The Alaska Telemedicine Testbed Project has received a one-year continuation of funding from the National Library of Medicine to complete Cost benefit analysis

Preliminary Conclusions

- Rural health care providers, especially the Community Health Aides, "love" the ATTP system and "don't know how they were able to do their jobs before the telemedicine system"
- As the result of the Alaska Telemedicine Testbed Project, Alaska's Congressional delegation has designated funding through IHS, VA, DOD, and DOT appropriations to deploy the ATTP system to all 235 villages and communities in rural Alaska

Region One Preliminary Data Analysis
Alaska Telemedicine Testbed Project
NLM Contract # N01-LM-6-3540

Frederick W. Pearce, Ph. D.
Principal Investigator
Director, Applied Science Lab, UAA

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For more information about the Alaska Telemedicine Testbed Project please visit our web site at:
http://appliedsci.uaa.alaska.edu/nlm

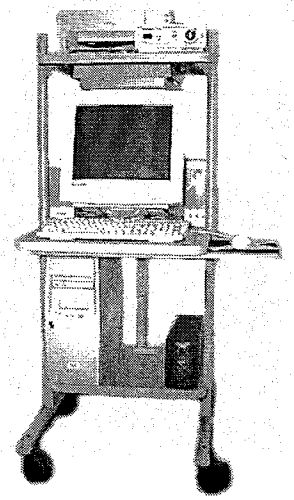
Region One Preliminary Data Analysis

Alaska Telemedicine Testbed Project
NLM Contract # N01-LM-6-3540

Stewart Ferguson, Ph.D.
Frederick W. Pearce, Ph.D.
Dennis G. Fisher, Ph.D.
Denise Statz, PA-C
Greg Storey

10,372

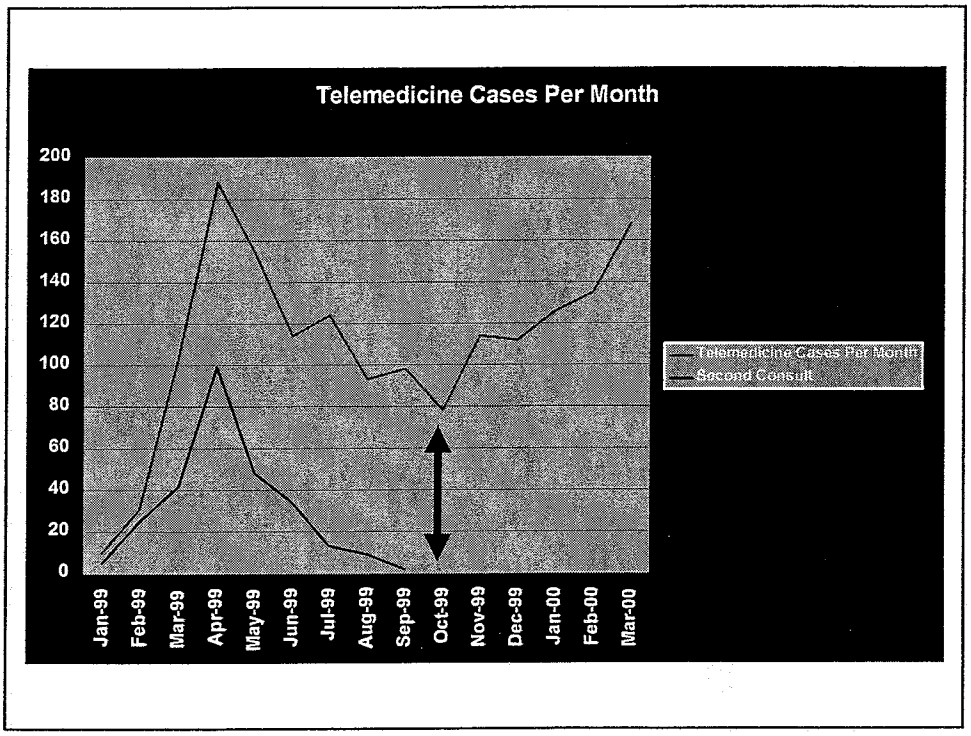
NLM - Region One Data

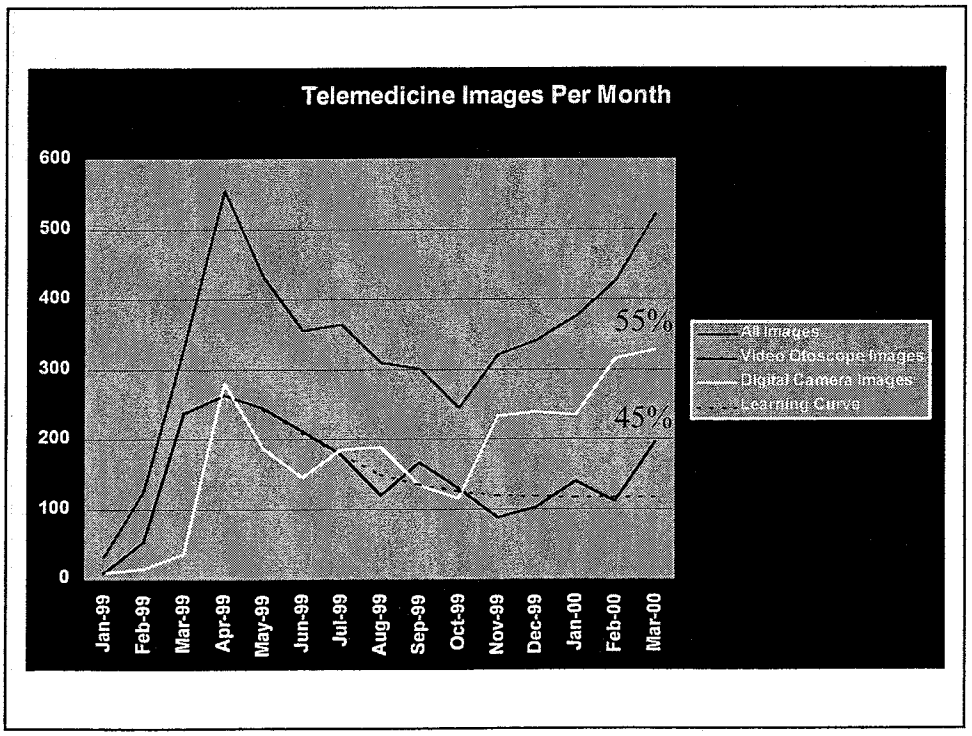


- 11 Village clinics
- Begin: 1/26/1999
- Gather: 4/14/2000
- 486 Days (319 workdays)
- 1715 Cases
- 5233 Images
  - 2340 Video otoscope
  - 2753 Digital camera

Equipment Usage

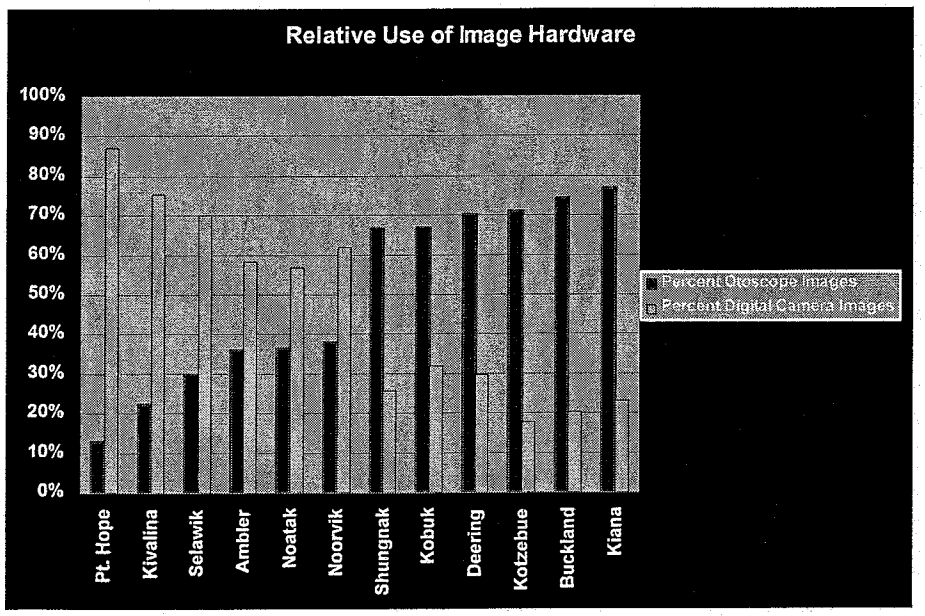
- Is it used?
- What equipment gets used the most?


Telemedicine Cases Per Month
200
180
160
140
120
100
80
60
40
20
0
Jan-99
Feb-99
Mar-99
Apr-99
May-99
Jun-99
Jul-99
Aug-99
Sep-99
Oct-99
Nov-99
Dec-99
Jan-00
Feb-00
Mar-00
Telemedicine Cases Per Month
Second Consult


Telemedicine Images Per Month
600
500
400
300
200
100
0
Jan-99
Feb-99
Mar-99
Apr-99
May-99
Jun-99
Jul-99
Aug-99
Sep-99
Oct-99
Nov-99
Dec-99
Jan-00
Feb-00
Mar-00
55%
45%
All Images
Video Otoscope Images
Digital Camera Images
Learning Curve

Equipment Usage

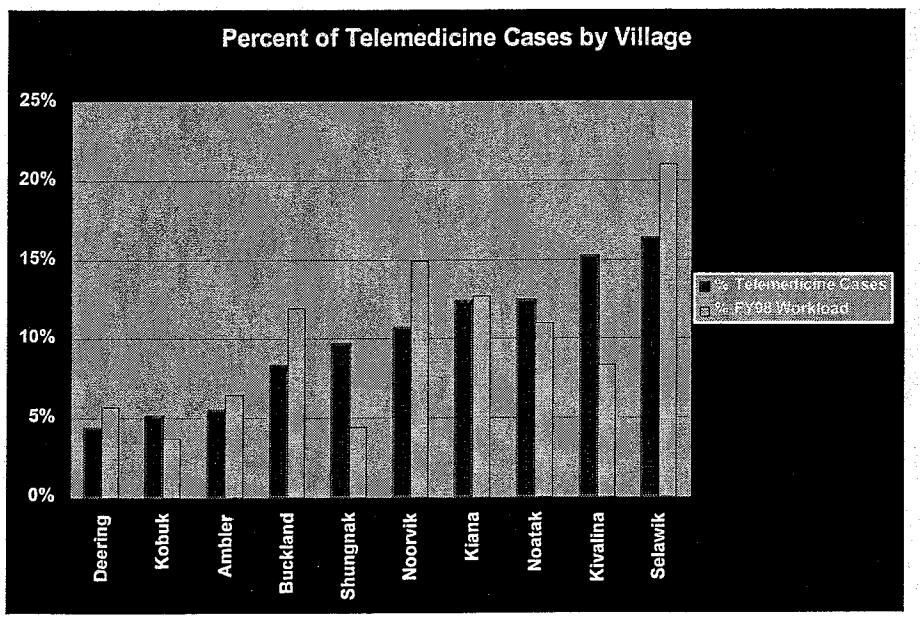
- Is it used?
- What equipment gets used the most?
- Do all villages use the equipment similarly?



10.375

What Determines Usage?

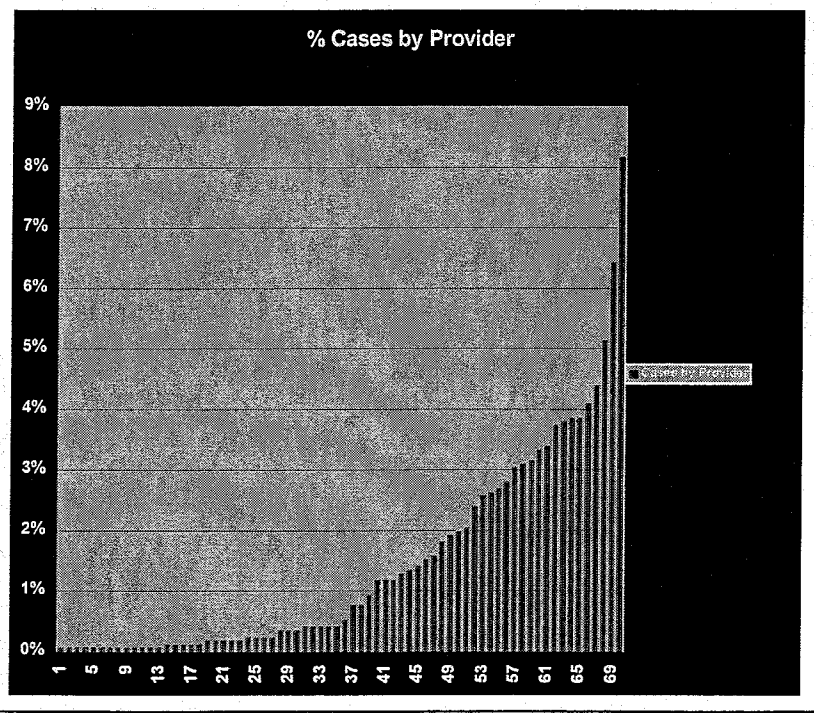
- Do clinics with heavier workloads use the equipment more or less?



10,376

What Determines Usage?

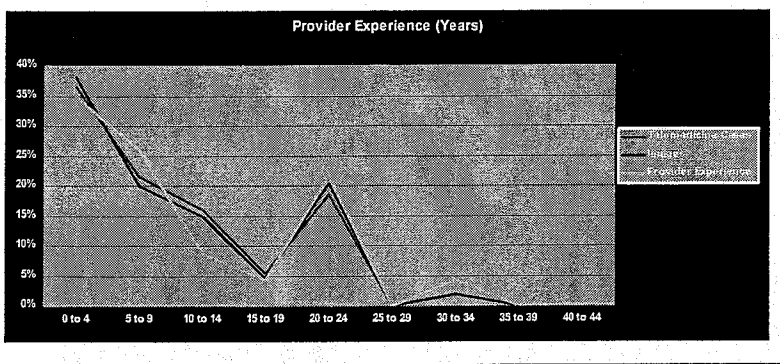
- Do clinics with heavier workloads use the equipment more or less?
- Do all Health Aides use the equipment?

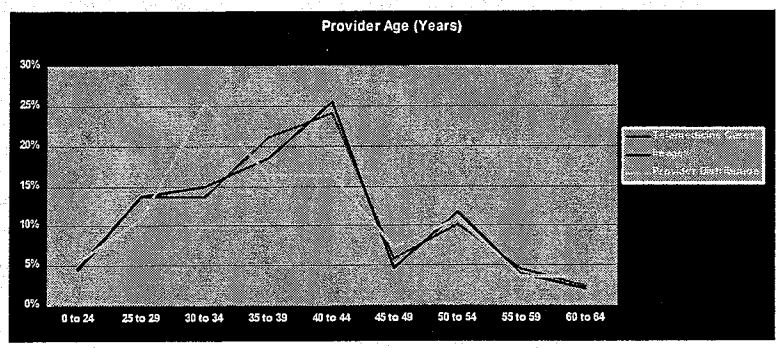


10,377

What Determines Usage?

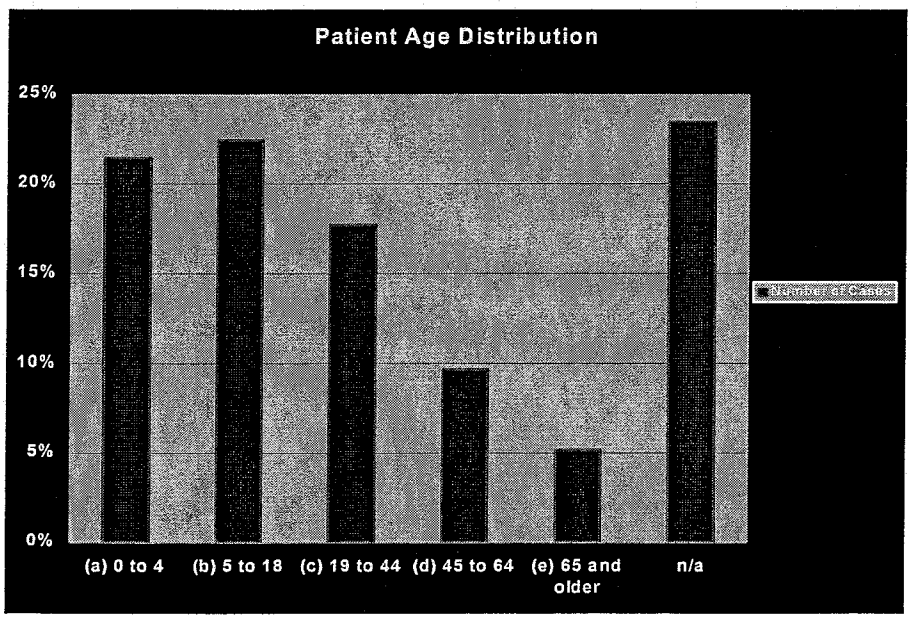
- Do clinics with heavier workloads use the equipment more or less?
- Do all Health Aides use it?
- Do more experienced providers use the equipment less?
- Do older providers use the equipment less than younger providers?

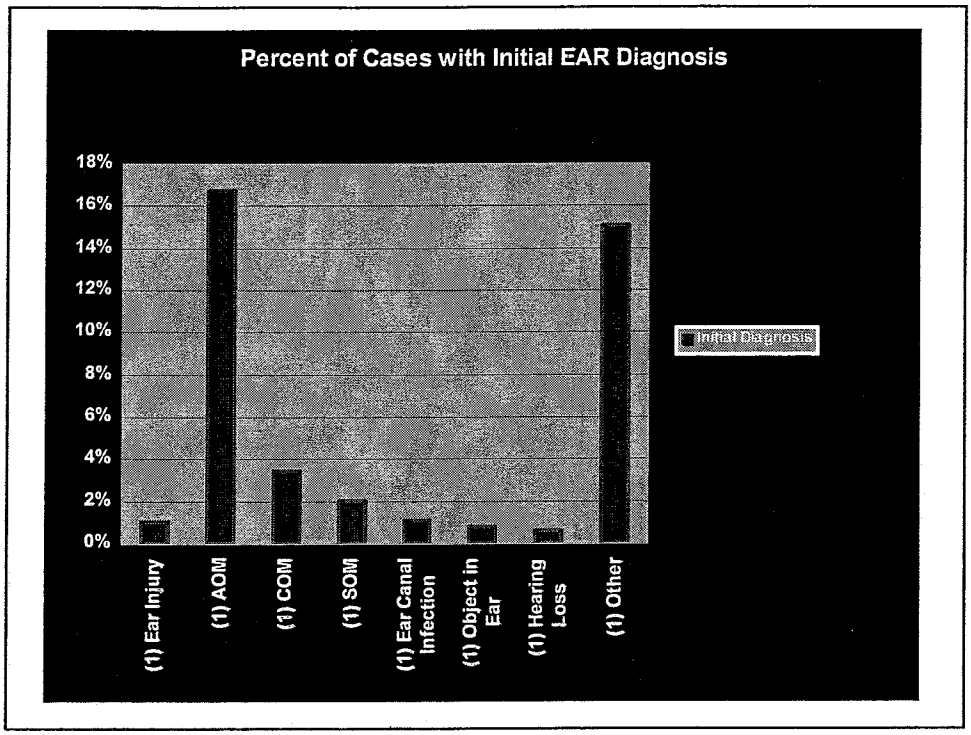




Patient Population

- What age groups are being served?
- What diagnosis is most common?

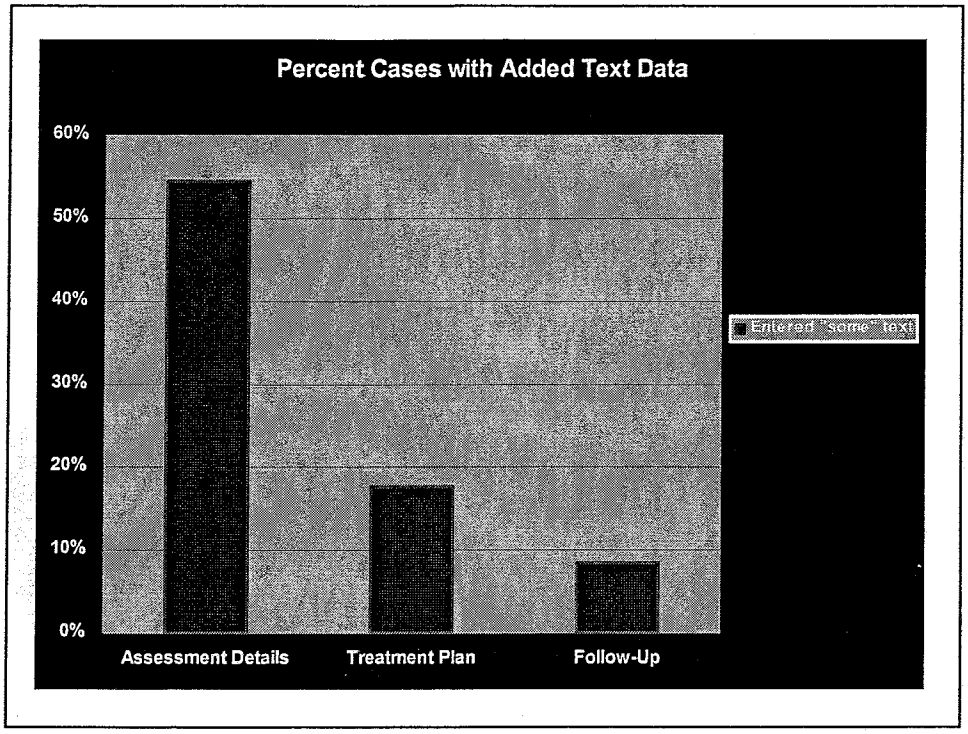


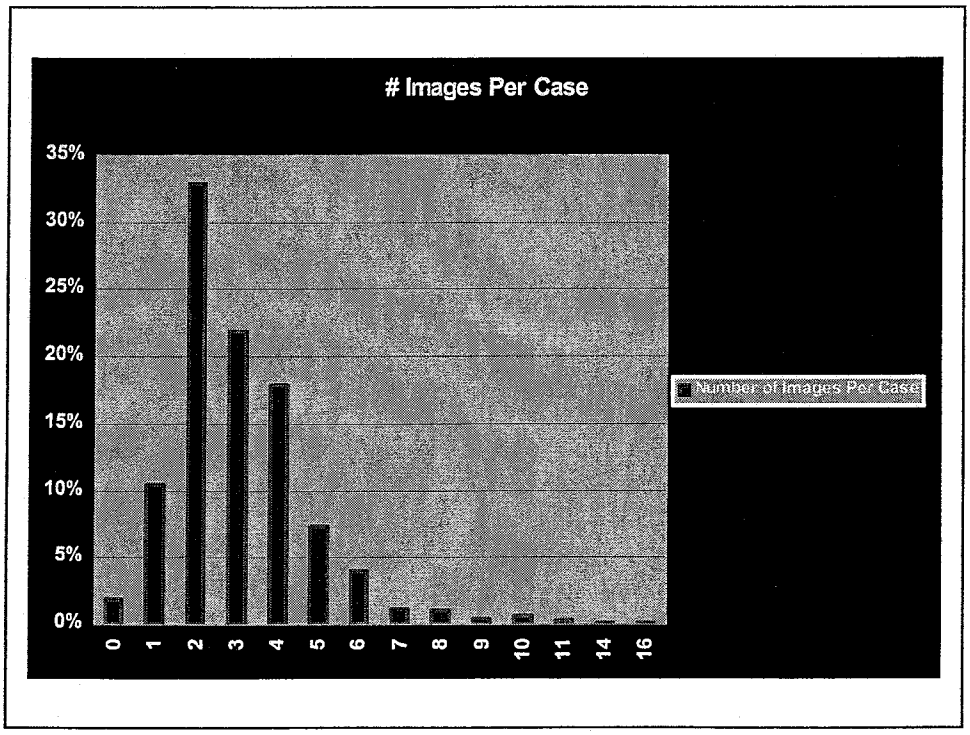


Software Issues

- How often do providers enter information with a case?
- How often do providers attach images - and how many?

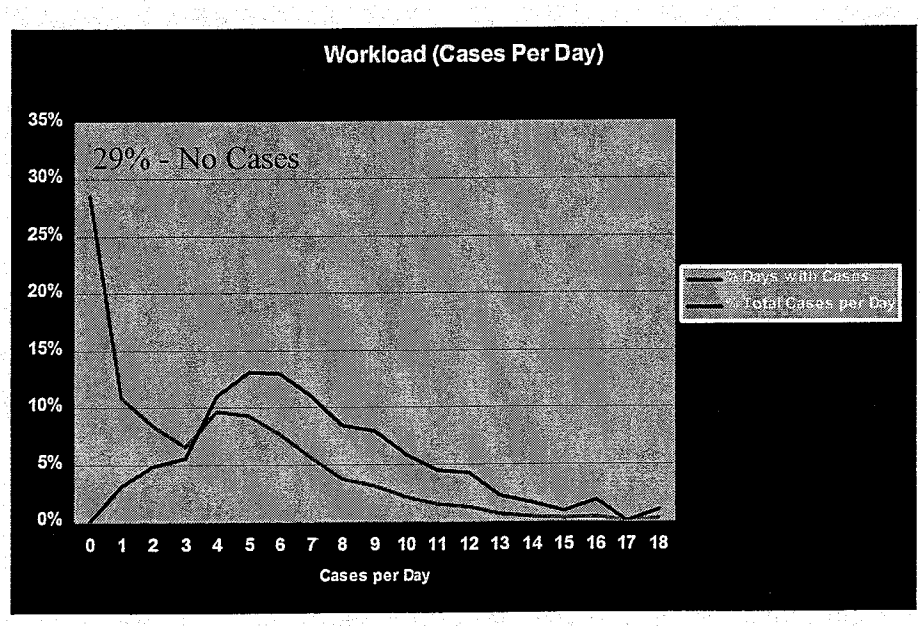
10,380

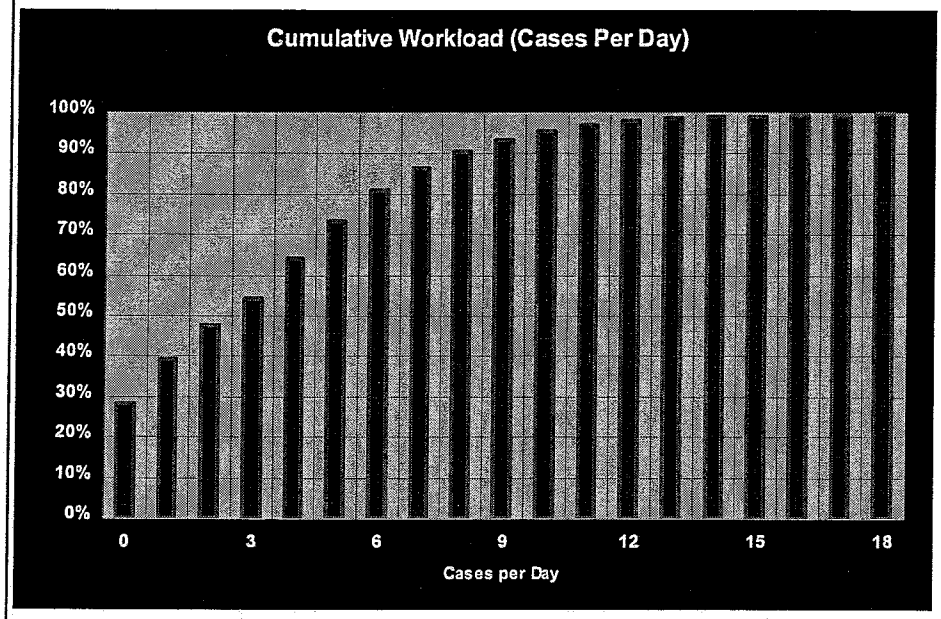

Percent Cases with Added Text Data
60%
50%
40%
30%
20%
10%
0%
Assessment Details
Treatment Plan
Follow-Up
Entered "some" text


Images Per Case
35%
30%
25%
20%
15%
10%
5%
0%
0
1
2
3
4
5
6
7
8
9
10
11
14
16
Number of Images Per Case

Physicians

- Do we burden physicians?
- How many and how often do cases arrive?





Remaining issues ...

- Quality of images
- Reasons for poor images

10,383

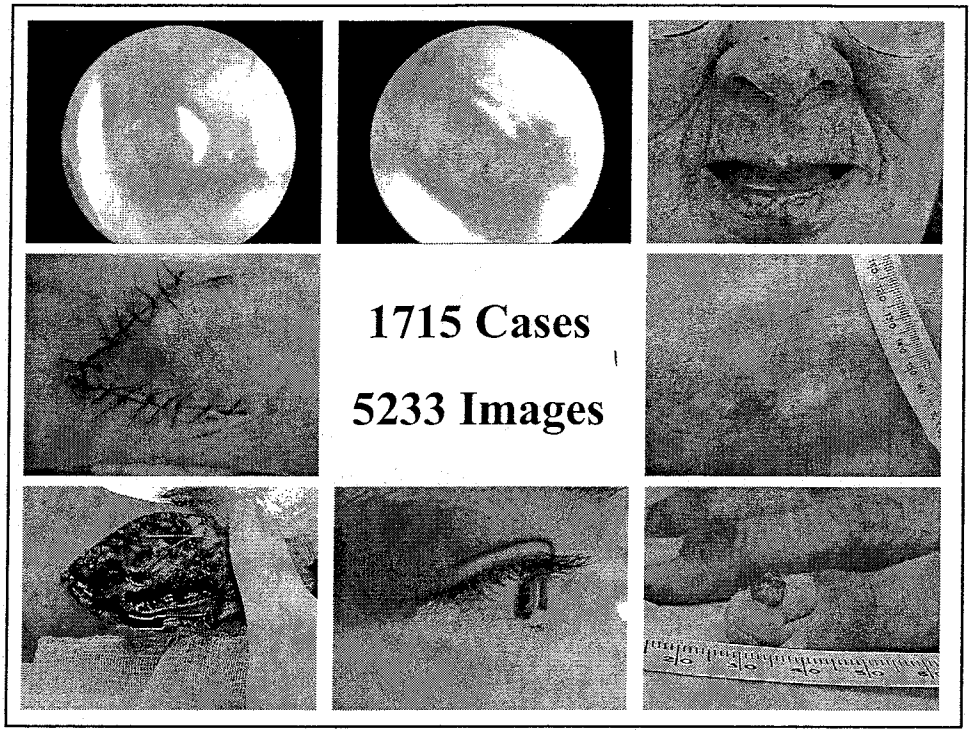
The 60,000' view

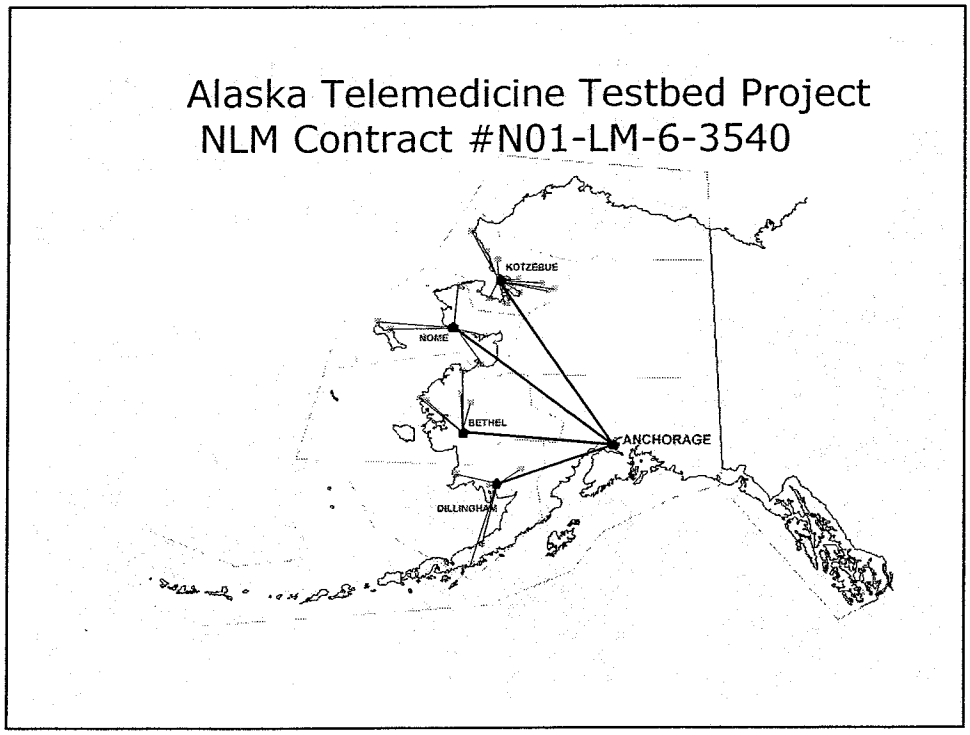
- Telemedicine can work very effectively in Alaska - perhaps better than anywhere else.
- Given organizational support - telemedicine will make a difference in the quality of care and support to providers.
- We can make it better.

- Everything looks very small from up here.

Acknowledgements

- The Health Aides, Physicians, and all the staff of Maniilaq Association. Special thanks to Eugene Smith and Dr. Shackles.
- Fred Pearce and the UAA telemed team.
- Denise Statz and ANHB staff.
- AFHCAN Project Office.
- The National Library of Medicine.


1715 Cases
5233 Images


Alaska Telemedicine Testbed Project
NLM Contract #N01-LM-6-3540
KOTZEBUE
NOME
BETHEL
ANCHORAGE
DILLINGHAM

10,386

Video Otoscope Testing

Prepared By

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11.4

Introduction

This report presents a summary of the testing conducted by the Alaska Native Health Board on video otoscopy equipment. The purpose of this testing was to examine the capabilities, limitations, and differences between the equipment provided by major manufacturers, and to determine the most suitable choice of equipment for the Alaska Telemedicine Testbed Project (funded by the National Library of Medicine -- NLM Contract No. N01-LM-6-3540).

Background: Telemedicine Programs in Alaska

Two projects presently being implemented in the state of Alaska share a common goal of linking remote villages in rural Alaska to regional hospitals, and linking the regional hospitals to the Alaska Native Medical Center (ANMC) in Anchorage. These projects are the Alaska Telemedicine Testbed Project funded by the National Library of Medicine (NLM Contract No. N01-LM-6-3540) and the AuroraNet Distance Delivery Health Care Project funded by the National Telecommunications Information Agency (NTIA).

In total, the two projects will link 32 villages, 5 regional hospitals, and ANMC. Future expansion will hopefully allow the remaining approximately 160 village and regional hospitals throughout Alaska to adopt the standards set by these 2 projects in implementing a statewide telemedicine network.

The Alaska Telemedicine Testbed Project is focused on diagnosing and treating ear disease, primarily due to the high incidence of ear disease within the Native population. This project requires a hardware solution (video otoscopy equipment) to obtain diagnostic-quality images of the ear canal and tympanic membrane -- as well as software solutions that will allow the store and forward of these images, patient records, email, and other forms of communication between the various health providers. The NTIA funded project is less focused on the single issue of ear disease, but plans to provide video otoscopy equipment to each site -- again due to the prevalence of ear disease throughout Alaska.

Alaska represents the prime location to test telemedicine hardware and software. Extremely limited and costly access to rural villages cries for a telemedicine solution. The harsh weather conditions, limited local health care facilities, large distances to secondary and tertiary care facilities, and high costs of travel make telemedicine an extremely attractive alternative. However, these same factors present an argument for providing hardware and software solutions that are extremely reliable, require little if any maintenance, provide the best quality images, and are easy to use.

The Purpose of this Testing

Recognizing that the hardware must meet stringent standards for deployment to rural villages in Alaska, it was important to review the available video otoscopy hardware to determine the equipment that best fit the needs of the project. The review, and subsequent hardware testing, was conducted by the Alaska Native Health Board (ANHB), a subcontractor to UAA on the NLM contract. A search was conducted to locate hardware vendors that manufacture or distribute video otoscopy hardware. Vendors were asked to submit sample hardware for evaluation purposes.

Varieties of tests were conducted on all equipment to determine the physical limitations of the hardware. This included tests on color accuracy, electronic (CCD) resolution, optical resolution, gain control, and other features of the systems. Physicians at hospitals as well as health aides in remote clinics will eventually use the hardware, so it was important to solicit comments from health

care providers at all levels. Many such providers were asked to review the equipment for ease of use, applicability to the task, image quality, and other features.

List of Vendors

Participating Vendors

- The following vendors participated directly in the demonstration, by supplying hardware for evaluation and by having a company representative available for discussion.

American Medical Development

Address:	22 Shattuck Street Lowell, MA 01852
Representative:	Mr. Mark K. VanderWerf
Title:	President
Phone:	800-742-1674
Fax:	508-937-5249
Email:	markv@americanmeddev.com
Comment:	Distributor for Welch Allyn equipment.

JEDMED Instrument Company

Address:	5416 Jedmed Ct. St. Louis, MO 63129-2217
Representative:	Mr. Thomas E. Schreiber
Title:	Customer Relations Manager
Phone:	314-845-3770
Fax:	314-845-3771

MedRx Inc.

Address:	13144 Park Blvd., Suite C Seminole, FL 33776
Representative:	Mr. Ken Meyer
Title:	Vice President., Sales Administrator
Phone:	888-392-1234
Fax:	813-392-9256

VCOM Systems

Address:	66 Edwards Avenue Sausalito, CA 94965
Representative:	Mr. Thomas P. Smith
Title:	Western Regional Manager
Phone:	415-331-9050
Fax:	415-331-6716
Email:	tsfairmed@aol.com

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Non-Participating Vendors

The following vendors were considered for the testing, but did not participate. This was usually because the list price of the equipment was well beyond the scope of the NLM project, the vendor was unresponsive to the request for evaluation hardware, or we were unaware of the vendor prior to conducting the testing.

Andries Tek

Address:	4314 Medical Parkway, Suite 9 Austin, TX 78756
Representative:	Mr. Alan W. Wassal
Title:	Director, Sales and Marketing
Phone:	800-395-1331
Fax:	512-453-8627
Email:	awassel@IO.com

Circon Corp.

Address:	46500 Hollister Av. Santa Barbara, CA 93117-3019
Representative:	Mr. Marc H. Effron
Title:	Group Product Manager - Endoscopy
Phone:	805-685-5100
Fax:	805-968-1265

Interpersonal Communications

Address:	3009 De La Vina Street Santa Barbara, CA 93105
Representative:	Amanda Samaha
Title:	Marketing Director
Phone:	800-355-0441
Fax:	805-569-3605
Email:	hal@west.net

Equipment and Methods

Manufacturer Specific Procedures and Comments

American Medical Development

AMD provided an AMD-300s Imaging and Illumination Platform and an AMD-2015 ENT Scope, all manufactured by Welch Allyn. The ENT scope uses rod lens optics. A single device provides both the light source (using an integrated Welch Allyn Solarc arc lamp with variable aperture control) and the camera electronics. The electronics provides both S-video and composite video outputs, and includes a single button white balance ("Color Reset" button) and a single button image sharpening filter ("Image Enhance" button).

Unless otherwise stated, the S-video output was utilized, the color was reset using a white image source before capturing any images, and the sharpening filter was not used.

AMD supplied two demonstration units at different times. The first unit was optimally tuned for ear images and exhibited minimal blooming and very accurate gain control and color accuracy. That unit had to be returned for other demonstration purposes before these tests were conducted. The second unit we obtained was not tuned optimally for ear images prior to shipment and was tested in this mode. Consequently, the AMD test results reported here may improve with a properly tuned system, and may be considered to be "worst case" results.

JEDMED Instrument Company

JEDMED provided the prototype model of their new VSS (Video Scope System) product. Only one prototype exists, and was available to be tested for only three days. This provided an insufficient time for performing a complete set of tests. However, where applicable, the results are reported here.

The JEDMED system consisted of an otoscope head with VSS camera, a Teli camera electronics CS6100 unit (serial #6100420) providing both S-video and composite video output, and a 150W fiberoptic light source (containing an integrated 150W halogen light bulb and dimmer switch).

Unless otherwise stated, the S-video output was utilized, camera electronics were set to have the shutter "On" and in "Auto" mode, white balance set to "Auto", and AGC set to "On".

We were notified on 12/23/97 that the unit we returned to JEDMED had a misalignment of the light bulb source and the fiber optic cable assembly. It is not clear if this misalignment occurred during the shipping back to JEDMED or during the shipping to us. If the latter was true, we tested a unit that was not functioning according to manufacturer's specifications. JEDMED has warned us that the misalignment would result in poor gain control, grainy pictures, poor illumination of the target, etc. We attempted to get the unit back for further trials, but JEDMED has only got the one "pre-manufacturing" prototype unit and the anticipated arrival of 25 new units has been postponed to January 1998.

MedRx Inc.

MedRx provided the key components of their "Deluxe Video Otoscope System", including the "deluxe" 3 mm otoscope probe (serial # 1500), a longer 5 mm probe (serial # 650), Watek 202B camera body (serial # 22154) with no aperture, Watek 202B camera (serial # 22979) with aperture, a control box with integrated probe stand, and a separate 150W fiberoptic light source (serial #08199765) containing an integrated 150W halogen light bulb and dimmer switch. Both Watek

- Images consisted primarily of resolution test patterns (Accu-Chart Resolution Chart) and a color accuracy chart (MacBeth ColorChecker chart). In most cases, the standard 8"x12" resolution chart was too large, and reduced-size photographs were obtained using extremely high grain film with custom developing to obtain high resolution prints for test images. See figure labeled *RESOLUTION TEST IMAGES* on the following pages. Note that resolution is determined at the limit whereby individual lines on the resolution patterns can no longer be discerned. Horizontal lines are used to measure the vertical resolution, and vertical lines are used to measure horizontal resolution (using a multiplier of 1.3 to account for the aspect ratio of the chart).

- A master list of all images was maintained with the specified conditions under which the images were obtained. This list is provided on the following pages (see table labeled *TEST IMAGE LIST*).

- Testing of the CCD and electronics, without the otoscope, was accomplished using a high quality Pentax 50 mm f/32 lens with macro capability.

List of Figures

This figure is included on the following page:

- *RESOLUTION TEST IMAGES.* Copies of the five photographs (each a 3.5" by 5" photograph) used for the majority of the resolution tests. The subject for all photographs was an Accu-Chart Resolution Chart, using either a portion or the complete chart as the image. Each photograph was shot using high resolution Ilford Pan F Plus film, and printed on glossy print paper.

RESOLUTION TEST IMAGES

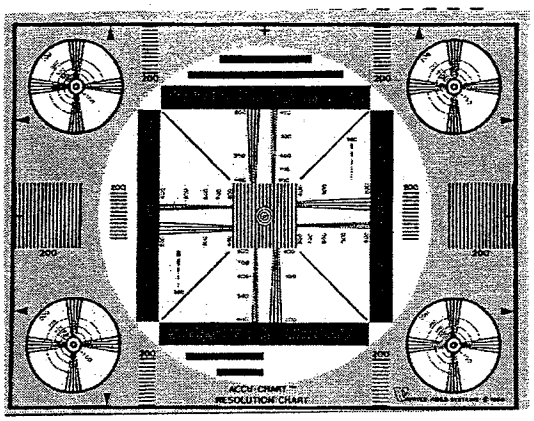

Photo #4

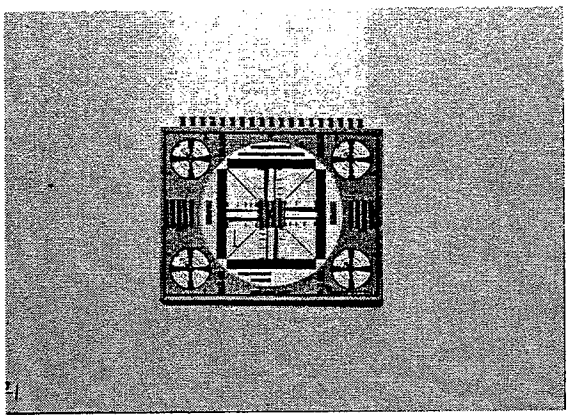

Photo #21

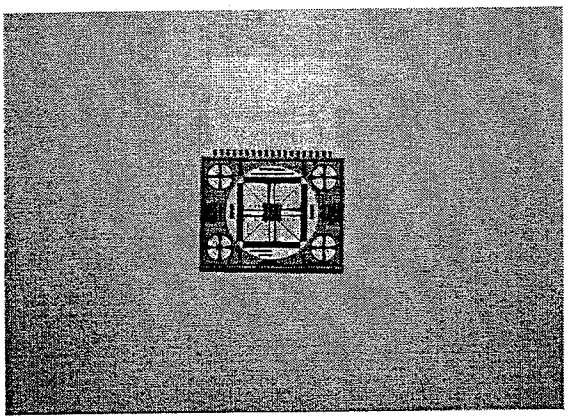

Photo #29

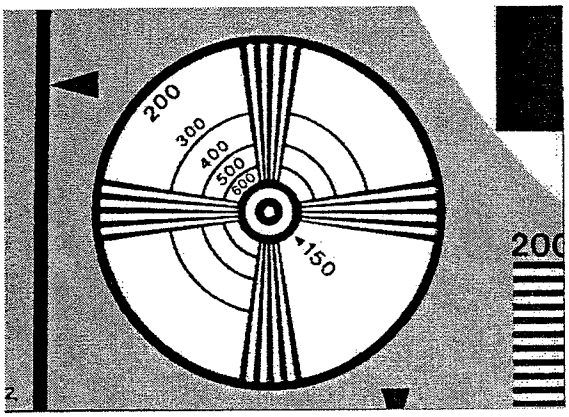

Photo #32

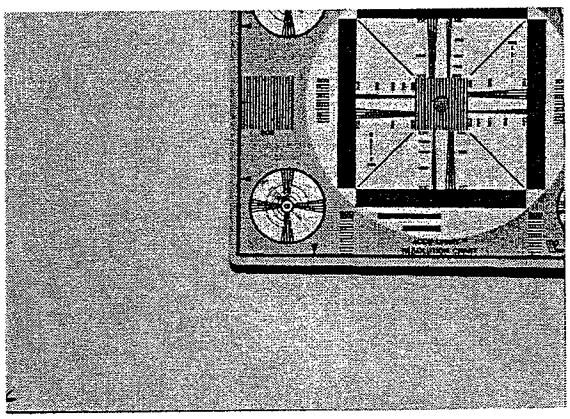

Photo #36

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List of Tables

These tables are included on the following pages:

- *TEST IMAGE LIST.* Table of all test images captured using each video otoscopy system. The subjects for most test images were either the MacBeth ColorChecker chart or photographs of the Accu-Chart Resolution Chart. The table lists the conditions under which each image was captured. (Note: "*x*" indicates the image was captured, "*n/a*" indicates the image was not captured and is *not available.*)

11.13

TEST IMAGE LIST

Part 1 of 2

Image #	Test Condition	Welch Allyn (AMD)	JEDMED	MedRX Inc.	VCOM Systems
	Otoscope Probe				
1	Photo 32 at a distance of 1 5/32" (plexiglass box) with indirect 3200K lighting, no speculum. Clean all lenses with alcohol before starting. Unless otherwise stated, all images taken without any filters. Unless otherwise stated, for MedRx use otoscope probe serial # 1500 with aparature, use camera without aparature, set white balance to auto, shutter to FL. When using long probe, use long probe serial # 650. MedRx camera is serial # 22154 with no aperature, serial # 22979 for camera body aperature. Unless otherwise stated, for VCOM use Heine Beat 200 otoscope head with Heine E7 120 VAC light source (serial #1449), beam splitter (serial #9128BS-NS/2583), Computar 2x extender EX2C, CCD camera head (serial #IK-M43H72), and Toshiba camera electronics model #IK-M43A (serial #99633636). For VCOM, use S-video output, AGC is OFF, and other settings are set to INIT FILE A mode. Unless otherwise stated, for JEDMED use otoscope head with VSS camera, S-video output from Teli electronics CS6100 unit (serial #6100420), 150W Fiberoptic Light source, set camera electronics to	x	x	n/a	x
1a	As for image 1 but with no aparatures (MedRx only)	n/a	n/a	x	n/a
1b	As for image 1 but with aparatures in otoscope only(MedRx only)	n/a	n/a	x	n/a
1c	As for image 1 but with aparatures in camera body only(MedRx only)	n/a	n/a	x	n/a
1d	As for image 1 but with aparatures in otoscope and camera body (MedRx only)	n/a	n/a	x	n/a
1e	As for image 1 but with long probe and no aparatures (MedRx only)	n/a	n/a	x	n/a
1f	As for image 1 but without 2X extender	n/a	n/a	n/a	x
2	Photo 32 at a distance of 5" with indirect 3200K lighting, no speculum	x	x	x	x (cannot focus this far)
2a	As for image 2 but with long probe (MedRx only)	n/a	n/a	x	n/a
3	Photo 36 at a distance to fill field of view, with full intensity lamp, no speculum, focused optimally at distance where image fills field of view. Bullseye pattern is 16mm diameter.	x	x	x	x (cannot focus this far - added 75W light)
3a	As for image 3 but with long probe (MedRx only). Note that full brightness saturated the camera, so the image was captured with the highest intensity light that did not saturate the image. Note the "skewed" center of light relative to the image center, and the yellow appearance of the white background.	n/a	n/a	x	n/a
4	Photo 32 at a distance to fill field of view with all other settings (light, focus, etc.) set as for image 3. This tests the ability to focus on a larger object when the focus is set for a smaller, nearer object. Bullseye pattern is 77mm diameter.	x	x	x	cannot do - too far
4a	As for image 4 but with long probe (MedRx only).	n/a	n/a	x	n/a
5	Photo 21 at a distance to fill field of view with all other settings (light, focus, etc.) set as for image 3. This tests the ability to focus on a smaller object when the focus is set for a larger farther object. Note: for MedRx, adjusted light intensity to approx 1/2 to prevent saturation of image. Bullseye pattern is 9mm diameter.	x	x	x	n/a
5a	As for image 5 but with long probe (MedRx only). Note that full brightness saturated the camera, so the image was captured with the highest intensity light that did not saturate the image. Note the "skewed" center of light relative to the image center, and the yellow appearance of the white background.	n/a	n/a	x	n/a
5b	As for image 5 except focus on photo at scope 1/8" from image				x
5c	As for image 5b (same focus) except move tip of scope 1/4" from photo				x
6	Photo 36 at 1", focused on center of image, full light, no speculum. For VCOM only, use AGC set "ON", battery powered light source.	x	x	x	x
7	As for image 6, except 1/2 light.	x	x	x	x
8	As for image 6, except 1/4 light.	x	x	x	x
14	Photo 21 at distance where fills screen (get center spot, and locate arrow at top of frame on edge of captured image) using otoscope on camera for testing resolution. Use fiber optic light source, full light	x	x	x	cannot focus
14a	Photo 29 at distance where best foccussed using otoscope on camera for testing resolution. Use fiber optic light source, full light. Note this is like image 14, except the smaller image lets the otoscope be focussed closer which is a fairer test for MedRx. For MedRx unit - focussed at 3/8 ". For VCOM only, focused at highest possible distance above photo, used 75W light positioned close to photo.		x	x	x
14b	As for image 14a but with long probe (MedRx only) focused at 3/8".	n/a	n/a	x	n/a
14c	As for image 14, except use left portion of photo		x		x
14d	As for image 14, except use upper portion of photo		x		x
15	As for image 14, except image enhancement is turned on.	x		n/a	n/a
50	Repeat image 14	x			
51	As for image 50, but with composite video.	x			
52	As for image 50 but with sharpness setting - unknown value.	x			
53	As for image 50, but with composite video and with sharpness setting - unknown value.	x			
54	Blooming - position otoscope approx 1/8" over "M" of the word "Macbeth" on the color chart, full brightness.	x		x	x
55	As for image 54 but with half brightness.	x		x	
56	Photo 21 with probe positioned directly on top (touching) photograph centered over bottom left "whirl" in bottom-left hand corner. Use fiber optic light source, full light.				x
56a	As for image 56, but use 2.4 mm speculum				x
56b	As for image 56, but use 3 mm speculum				x
56c	As for image 56, but use 5 mm speculum				x
57	As for image 56, except do not use the 2X coupler.				x
57a	As for image 57, but use 2.4 mm speculum				x
57b	As for image 57, but use 3 mm speculum				x
57c	As for image 57, but use 5 mm speculum				x

11.14

TEST IMAGE LIST

Part 2 of 2

Image #	Test Condition	Welch Allyn (AMD)	JEDMED	MedRX Inc.	VCOM Systems
	Camera With Coupler				
9	Photo 4 at distance where fills screen using adapter on camera (not otoscope probe) for testing resolution. Light source is indirect 3200K light, positioned over camera pointing at photo.	x	x	n/a	x
9a	As for image 9, except use composite-video output		x		x
10	As for image 9, except 3200K light source is held very close to photo to fully illuminate photo. Used for determining the lines of resolution of the adapter.	x	x	n/a	n/a
11	As for image 10, except image emhancement is turned on.	x	n/a	n/a	n/a
12	As for image 9, except 3200K light source is bounced off ceiling to poorly illuminate	x	x	n/a	n/a
13	As for image 12, except image emhancement is turned on.	x	n/a	n/a	n/a
	Camera With 50 mm Lens				
16	Photo 4 at distance where fills screen using Pentax 50 mm lens at f32 for testing resolution. Light source is indirect 3200K light, held very close to photo to fully illuminate photo.	x		x	
17	As for image 16, except use f11. Use this for final resolution numbers.	x		x	
18	As for image 16, except use f2.8. For MedRx, have to move light farther away to prevent whiteout on the image.	x		x	
19	As for image 17, except use composite video input instead of s-video input.	x			
19a	As for image 17, except use composite video with sharpness 2			x	
19b	As for image 17, except use composite video with sharpness 4			x	
19c	As for image 17, except use composite video with sharpness 7			x	
20	At full brightness with otoscope probe, color balance on white Macbeth. Then position otoscope probe in white cap (approx 1/4" from end of cap) and position over blue Macbeth with full light.	x			
21	Without resetting color balance, position over green Macbeth with full light.	x			
22	Without resetting color balance, position over red Macbeth with full light.	x			
23	Without resetting color balance, position over blue Macbeth with half light.	x			
24	Without resetting color balance, position over green Macbeth with half light.	x			
25	Without resetting color balance, position over red Macbeth with half light.	x			
26	Without resetting color balance, position over blue Macbeth with quarter light.	x			
27	Without resetting color balance, position over green Macbeth with quarter light.	x			
28	Without resetting color balance, position over red Macbeth with quarter light.	x			
29					
30	Macbeth at distance where overfills screen using Pentax 50 mm lens at f2.8. Light source is indirect 3200K light, held over camera (for MedRX - due to poor shutter control, the light is held closer to the Macbetth chart - approx 3' away). System is white balanced by bringing white Macbeth close to lens and focussing in on it with good illumination from 3200K (AMD only - MedRx is set at AUTO white balance).	x		x	
31	As for image 30, with lighting bounced off ceiling from the point at which the light was positioned for image 30.	x		x	
32	As for image 30, with same light but f11.	x		x	
33	As for image 30 with standing halogen lighting.	x		x	
34	As for image 31 with standing halogen lighting.	x		x	
35	As for image 32 with standing halogen lighting.	x		x	
36	As for image 30 with 75 watt incandescent bulb plus overhead 75 watt incandescent.	x		x	
37	As for image 31 with 75 watt incandescent bulb bounced of celing and overhead 75 watt incandescent turned off	x		x	
38	As for image 32 with 75 watt incandescent bulb plus overhead 75 watt incandescent.	x		x	
		x			
40	Macbeth at distance where overfills screen using Pentax 50 mm lens at f2.8. System is white balanced as for image 30 using incandescent 75 watt bulb. Lighting for image capture is standing halogen bulb.	x		n/a	
41	As for image 40, with lighting for image capture is 3200K bulb.	x		n/a	
42	Macbeth at distance where overfills screen using Pentax 50 mm lens at f2.8. System is white balanced as for image 30 using 5400K built in light source. Lighting for image capture is standing halogen bulb.	x		n/a	
43	As for image 42, with lighting for image capture is 3200K bulb.	x		n/a	
44	As for image 42, with lighting for image capture is overhead 75 watt incandescent bulb.	x		n/a	
45	Repeat image 30			x	
46	As for image 30, with white balance set to "lamp" position			x	
47	As for image 30, with white balance set to "manual", adjustment set to extreme "B" position			x	
48	As for image 30, with white balance set to "manual", adjustment set to middle position			x	
49	As for image 30, with white balance set to "manual", adjustment set to extreme "R" position			x	

11.15

Testing Electronics

Introduction

All tested equipment relied on an electronic camera to transfer the optical image generated by the otoscope probe into a video signal that could be captured and/or displayed on a computer. The camera consists of an image sensor (typically referred to as a "CCD" or charge-coupled device) and associated electronics to transfer the sensor output to a video signal. The electronics provide gain control to the sensor to compensate for lighting conditions, and provide color balance to generate appropriate color output based on the illumination of the image.

An example of the components specific to the video otoscope is shown in the figure entitled *WELCH ALLYN OTOSCOPE HEAD.* The otoscope head consists of a camera and a probe, but may also include a coupler (as shown here) to connect the camera to the probe. The camera cable leads to the electronics and the fiber optic cable leads to the illumination source. Several variations were used by manufacturers for the cabling system. Welch Allyn employs two cables, as shown here, that lead to a single integrated electronics/light source device. JEDMED employs one cable that leads to two separate boxes. Both VCOM and MedRx employ two cables leading to two separate boxes.

Ultimately, the quality of the image generated by an entire video otoscope system is limited by the poorest component of the system. The goal of these tests was to determine the limitations introduced strictly by the camera, the coupler, and the electronics of the otoscope system, without considering the limitations of the optics of the probe itself.

Resolution of Camera

These tests were conducted to determine the lines of resolution provided by the camera and electronics. The term "lines of resolution" is a specification often provided by manufacturers of digital camera equipment, and may refer to the number of horizontal video lines provided in the signal output from the camera. However, this specification does not necessarily match the actual number of physical lines that can be discerned by the camera on a test image. For example, a camera producing 450 lines of video output is usually not able to produce an accurate image of a test pattern containing 450 lines of alternating black and white color.

Another typical specification for camera resolution is the number of elements in the CCD sensor. For example, a 1/3" CCD may contain 420,000 elements, but this does not mean that the sensor can detect 420,000 separate pixels on the test pattern. The CCD elements may be grouped in 2x2 arrangements to provide color output since CCD elements are not naturally color sensitive but can be made color sensitive by placing red, green and blue masks over the elements. Using a 2x2 grid reduces the actual number of "color sensitive" elements on a 420,000 CCD to 105,000 elements. This would be capable of discerning 375 by 280 separate pixels on a test pattern - quite different from the anticipated 640 by 480 pixels normally used for image captures.

The resolution of the camera was tested by replacing the otoscope probe and coupler (if any) on each system with a high quality Pentax 50 mm f/32 lens with macro capability. A Pentax-to-C mount adapter and an additional C-to-CS adapter allowed this lens to be coupled to both the standard C or CS lens mounts of the cameras supplied with the Welch Allyn and MedRx systems. The lens could not be coupled to either the VCOM or the JEDMED unit; the VCOM unit coupled to a standard eyepiece of a scope and the JEDMED camera utilized a proprietary coupling.

11.16

The captured images are shown in the figure entitled *RESOLUTION WITH 50mm LENS*. These images were studied to determine the limit at which lines on the resolution patterns could no longer be discerned. The results, and the manufacturer's claimed resolution, are shown in the table entitled *RESULTS: RESOLUTION*.

The Welch Allyn camera exhibited the sharpest resolution using S-video output, attaining a resolution of 455 horizontal by 350 vertical (455h x 350v) lines of resolution. Using composite video instead of S-video output, the horizontal resolution dropped noticeably from 455 to 325 lines. The MedRx camera, using only the composite video output, attained a similar resolution of 358h x 325v. Note that neither Welch Allyn nor MedRx attained the resolution claimed by the manufacturer. The differences between these systems, and between composite and S-video outputs of the Welch Allyn electronics, are easily seen from the captured images.

Resolution of Camera and Coupler

Three of the four systems tested employed a "coupler" to connect the camera and CCD sensor to the actual otoscope probe (see figure entitled *WELCH ALLYN OTOSCOPE HEAD* for example). Initially, we felt it was probably safe to assume this coupler did not distort the image significantly and would play no part in affecting the resolution of the entire system. However, it became clear that some couplers did distort the image, and hence the resolution of the camera was tested using the coupler supplied by the manufacturer.

The resolution of the coupler and the camera was tested by removing the otoscope probe on each system but leaving the coupler attached to the camera. The MedRx system was not tested because it does not employ a coupler. Both the short and long MedRx probes connect directly to the camera. MedRx does offer a coupler that may be used for purposes other than otoscopy, but this test was designed to investigate the extent to which the coupler affected the resolution of the images obtained during video otoscopy.

Images were captured of a test pattern illuminated by a 3200K light bulb positioned very close to the test pattern to obtain the brightest possible image (identical to the tests with the 50mm lens). The VCOM system required the light source be positioned farther from the test pattern because the VCOM coupler had a very narrow field of view (otherwise the light source obstructed the image of the test pattern). The captured images are shown in the figure entitled *RESOLUTION WITH COUPLER*. Similar to the above tests with the 50mm lens, these images were studied to determine the limit at which lines on the resolution patterns could no longer be discerned. The results are shown in the table entitled *RESULTS: RESOLUTION*.

Only the Welch Allyn camera was tested using both the 50mm lens and the coupler. The resolution decreased using the coupler (423h x 325v) compared to the 50mm lens (455h x 350v). This verifies that the 50mm lens was a higher quality lens than the coupler, but also that the coupler introduced a discernable distortion in the image. This distortion is evident in the captured image, particularly at the edges of the test pattern. The bullseye patterns located in the corners of the test pattern were blurred. This suggests the resolution values obtained using the coupler should more properly be called "resolution near center" of image. Notably, the vertical test bars at the left and right edge, representing 260 lines of resolution, can barely be discerned despite the much higher resolution (423h) near the center. Overall, the optical quality of the coupler is sufficiently poor to cause a loss of resolution in the image.

The JEDMED coupler and camera attained a higher resolution near center (488h x 325v) than Welch Allyn. However, the distortion and blurring at the edges of the image were significantly greater. The vertical lines near the left and right edges of the test pattern (260h lines of resolution) cannot be discerned in the captured image from the JEDMED system. The resolution diminishes to a very low value near the edges due to the significant distortion introduced by the coupler.

The VCOM coupler and camera attained an identical resolution value (488h x 325v) to the JEDMED system, but did not suffer from the distortion apparent in the JEDMED coupler. Overall, the VCOM System attained the best resolution of all couplers tested and introduced the least distortion at the edges of the image.

The results shown in the table entitled *RESULTS: RESOLUTION* also indicate the "field of view" of the 50mm lens and the couplers provided by each manufacturer. Field of view was determined based on the distance between the end of the coupler or lens and the test pattern. The 50mm lens attained an identical field of view (7.7°h x 5.9°v) as the coupler from Welch Allyn. That coupler was marked as a 45mm coupler, suggesting that the calculations of field of view are close but incorrect. Most probably, the distance to the test pattern should not have been measured from the end of the coupler or lens but from the plane of the CCD device. This would change the field of view calculations by less than 5%, but would slightly reduce the field of view of the 50mm lens relative to the 45mm coupler as would be expected.

The JEDMED coupler had a significantly wider field of view (11.7°h x 9.0°v) than the 50mm lens and Welch Allyn coupler. This is consistent with the increased distortion observed from this coupler, because wide-angle lenses tend to have exaggerated distortion at the edges of images.

Factors Affecting Resolution

The Welch Allyn system provides an "Image Enhancement" control on the main unit that "sharpens" the image-- presumably using a high-pass filter on the horizontal sweep. If so, this would not be expected to change the vertical resolution but would increase the horizontal resolution. Captured images, shown in the figure entitled *FACTORS AFFECTING RESOLUTION* indicate the effect on the image of the test pattern. The horizontal resolution, shown in the table entitled *RESULTS: RESOLUTION,* did increase from 423 to 488 horizontal lines of resolution with this feature, but the vertical resolution remained unchanged.

All systems tested using a coupler (Welch Allyn, JEDMED and VCOM) also provided both S-video and composite video outputs from the camera electronics. The effect of using either output is shown in the figure entitled *FACTORS AFFECTING RESOLUTION.* Composite video output generally provided a poorer quality image with lower horizontal resolution. The horizontal resolution, shown in the table entitled *RESULTS: RESOLUTION,* decreased from 488 to 358 horizontal lines of resolution for both the JEDMED and VCOM systems using the S-video and composite video outputs respectively. The effect on the resolution of the Welch Allyn coupler and camera was not tested.

Gain Control

Automatic Gain Control (AGC) is inherent to all systems, and provides a mechanism for the imaging system to compensate for the illumination of the image. A "perfect" AGC would allow the darkest images to appear bright and clear, and prevent intensely bright images from saturating the output. In reality, all systems have a minimum level of light intensity, below which the image cannot be detected by the CCD. All systems likewise have a limited ability to compensate for extremely bright images.

The method by which gain control is implemented also affects the ability to correctly view high contrast images. Poor AGC would reduce the contrast to allow the image to fit into a narrow contrast window, whereas good AGC maintains the overall contrast in the image.

Poor gain control may also be displayed as "blooming" in an image. Blooming is an artifact resulting from the inability for the electronics to compensate for regions of saturated (bright) light, causing a bright area to overflow onto adjoining pixels. Blooming is a very important aspect of

video otoscopy due to the possibility of wax and "shiny membranes" to produce highly reflective surfaces.

Gain control was first tested in a configuration with the otoscope probe on each system replaced by a high quality Pentax 50 mm f/32 lens with macro capability (see preceding section on Resolution tests). The lens could not be coupled to either the VCOM or JEDMED units. The ability of the electronics to respond to varying light conditions was tested by varying the aperture on the lens. The captured images are shown in the figure entitled *GAIN CONTROL WITH 50mm LENS.* The Welch Allyn equipment afforded the greatest range of gain control, providing a nearly uniform image output across a broad range of lighting conditions. There was very little change in the image brightness or contrast despite varying the aperture from f/2.8 to f/32. The MedRx unit exhibited poorer gain control, providing a dark image at f/32 and a completely saturated image at f/2.8 (not shown in the figure since it was completely white).

Gain control was also tested using the otoscope probes supplied by the manufacturers. The otoscope probe was focused on a test pattern with the otoscope light source set at full brightness. This captured image was termed the "initial image". A larger test pattern was then positioned to generate a similar image to the " initial image". This test pattern, being larger, had to be positioned farther from the probe to generate a similar image. The captured image, termed "distant image", may be expected to be darker. A smaller test pattern was also positioned to generate a similar image to the " initial image". This test pattern, being smaller, had to be positioned closer to the probe. The captured image, termed "closer image", may be expected to be brighter.

The captured images are shown in the figure entitled *GAIN CONTROL WITH PROBE.* Similar to the above results, the Welch Allyn equipment afforded the greatest range of gain control, providing a nearly uniform image output across this broad range of reflected light. There was very little change in the image brightness or contrast. The MedRx unit exhibited poorer gain control, providing a darker image for the distant test pattern and a completely saturated image for the closer test pattern (not shown in the figure since it was completely white). The JEDMED unit exhibited poor gain control also, having a saturated image for both the initial and close test patterns and a dark image for the distant pattern. The VCOM unit could not be tested because the image was uniformly dark due to poor light output from the unit.

Blooming was tested using the otoscope probe focused on a small reflective portion of the Macbeth Color Checker Chart (literally on the letter "M" of the word "Macbeth"). This consisted of a reflective silver letter set against a flat-black background. The otoscope light source was set at full intensity and then half intensity for this test. The captured images are shown in the figure entitled *BLOOMING.* The Welch Allyn equipment exhibited negligible blooming, providing almost identical images at both full and half intensity. The MedRx unit exhibited severe blooming at full intensity, and none at half intensity. VCOM exhibited no blooming at full intensity, possibly due to the very weak light source. At half intensity, the unit could not generate an image output because the light source was insufficient to illuminate the test pattern.

The results, and the relevant manufacturer's specifications, for the tests on gain control and blooming are shown in the table entitled *RESULTS: GAIN CONTROL.* Overall, the Welch Allyn equipment exhibited the best gain control and least blooming of all tested units. MedRx exhibited poor gain control and some blooming. VCOM provided reasonable gain control and minimal blooming. JEDMED exhibited fair gain control and no blooming.

Color Accuracy

The color accuracy that can be achieved by an imaging system depends on many factors, including the "temperature" of illumination, the "white balance" of the system, the intensity of illumination, and actual color range in the image. Typically, an imaging system is "white balanced" to a specific color temperature. The concept of relating "white light" to a color temperature is based on the

spectrum of light that emanates from a carbon block heated to that temperature. From this setting for "white", other colors can be reliably determined with a fair degree of certainty. For example, the light bulb used in some photography floodlights use a tungsten filament that burns at 3200K (the units of temperature being Kelvin, where 273K = 0° Centigrade and 3200K = 2927° Centigrade), whereas a halogen light bulb burns at 3400K. The Solarc bulb supplied with the Welch Allyn equipment has a color temperature of 5500K, and the light output is noticeably "whiter" than that generated from a regular incandescent bulb.

Color accuracy is dramatically affected when the white balance setting for the imaging system is inconsistent with the color temperature of the illumination source. For example, setting the white balance based on a 5500K color temperature but using a 3200K light source produces a color shift. Generally, balancing at a high temperature but using a lower temperature illumination causes a shift towards yellow or red colors. Balancing at a low temperature but using a higher temperature illumination causes a shift towards blue colors.

Color accuracy is less severely, but still noticeably, affected by changes in the intensity of illumination. Very intense illumination will ultimately cause any imaging system to saturate and generate very pale colors, whereas very weak illumination will result in very dark colors.

A variety of schemes exists for developing a quantitative assessment of the color accuracy of an imaging system. The method we hoped to adopt for these tests relies on the ability to numerically compare the chromaticity and luminous reflectance of the captured image (using the CIELa*b* color space) to the "actual" values of the Macbeth Color Checker chart. Unfortunately, the "actual" values published by the manufacturer of the card (GretagMacbeth) apply to a specific lighting condition that differs from our lighting conditions during the tests. Until we can obtain those values, a quantitative assessment is not possible.

Color accuracy was tested using the 50mm lens focused on the Macbeth Color Checker Chart, with a variety of lighting conditions, aperture settings, and settings for "white balance". Only those imaging systems could be tested for which an image of the Macbeth ColorChecker chart could be captured in its entirety. This required using the configuration whereby the otoscope probe on each system was replaced by a the Pentax 50 mm f/32 lens (see earlier section on Resolution tests). Again, only the Welch Allyn and MedRx units could be tested in this manner. The Welch Allyn system provides a single button labeled "Color Reset" which is used to set the white balance. Simply pointing the camera at an illuminated white surface, and pressing this button, sets the white balance for that illumination temperature. The MedRx system provides a slide switch with three settings: "auto", "bulb" and "manual". In the "manual" setting, an additional control may be used to adjust the white balance over a wide range of red to blue. The "bulb" setting appears to be designed for lower temperature light, whereas the "auto" setting works well around 3200K.

Some captured images for the Welch Allyn system are shown in the figure entitled *COLOR ACCURACY - WELCH ALLYN (AMD).* When the system was white balanced appropriately, the captured images achieved good color accuracy at all intensities of illumination. Color accuracy was best using less intense illumination - either using a tighter aperture at f/11 (lower left figure) or weaker light (lower right figure). Intense illumination with an open aperture at f/2.8 (center left figure) caused the colors to appear faded and pale. The worst color accuracy occurred when the system was balanced for the wrong temperature. Balancing for 5500K then using 3200K to illuminate the chart (center right figure) produced a distinct shift towards yellow colors.

Captured images for the MedRx system are shown in the figure entitled *COLOR ACCURACY - MEDRX INC.* When the system was white balanced appropriately, the captured images achieved good color accuracy only at higher intensities of illumination. Intense illumination with an open aperture at f/2.8 (center left figure) produced good color accuracy - better than the Welch Allyn equipment. Color accuracy was poor using less intense illumination - either using a tighter aperture

at f/11 (lower left figure) or weaker light (lower right figure). These images appeared dark and gray. Again, the worst color accuracy occurred when the system was balanced for the wrong temperature. Balancing for "lamp" (presumably a lower temperature) then using 3200K to illuminate the chart (center right figure) produced a blue shift in all colors.

While these tests were performed using a 50mm lens to capture the entire Macbeth chart, other subjective tests were conducted to monitor the changes in color accuracy using the otoscope probe without the Macbeth chart. Any system employing a Halogen light source (JEDMED and MedRx) suffered from a noticeable shift towards red colors as the intensity of the light source was reduced. This appears to be the nature of halogen light bulbs, producing only a "white" light at full intensity and a more "red" light at lower output. This caused the captured images to appear redder at lower light intensities. This phenomenon was not observed in the system using an arc lamp (Welch Allyn), because the light output is adjusted using an aperture rather than adjusting the power to the light bulb. This maintains the "true white" source, regardless of the intensity desired from the source.

List of Figures

These figures are included on the following pages:

- *WELCH ALLYN OTOSCOPE HEAD.* Diagram of the Welch Allyn otoscope head and the individual components. The "butterfly" knob near the center of the coupler is used to focus the image manually. The white dot on the camera (bottom image) is used to indicate "right side up" for the image on the camera CCD sensor.

- *RESOLUTION WITH 50mm LENS.* Captured images from the Welch Allyn and MedRx systems using composite and S-video (Welch Allyn only) output. A 50mm lens set at f.11 was coupled to the CCD camera using a C or CS-mount adapter. The lens could not be coupled to either the VCOM or the JEDMED unit; the VCOM unit coupled to a standard eyepiece of a scope and the JEDMED utilized a proprietary coupling. The captured images shown here are Test Image #17 (for Welch Allyn S-video and MedRx composite video) and Test Image #19 (for Welch Allyn composite video) previously described in the table entitled *TEST IMAGE LIST.*

- *RESOLUTION WITH COUPLER.* Captured images from the Welch Allyn, JEDMED and VCOM systems using S-video output generated from camera attached to the coupler supplied with the system, but with the probe removed. Images could not be obtained using the MedRx unit because a coupler was not required with the system. The captured images shown here are Test Image #9 previously described in the table entitled *TEST IMAGE LIST.*

- *FACTORS AFFECTING RESOLUTION.* Captured images from the Welch Allyn, JEDMED and VCOM systems demonstrating the effects of various factors on the resolution of the camera and electronics. Images were obtained using the camera attached to the coupler supplied with the system, but with the probe removed. The effect of Welch Allyn's "image enhancement" feature is shown in the top images. The middle and bottom images display the effect of S-video versus composite video output on the resolution of the test pattern. The captured images shown are Test Image #10 (top left), #11 (top right), #9 (middle left, bottom left) and #9a (middle right, bottom right) previously described in the table entitled *TEST IMAGE LIST.*

- *GAIN CONTROL WITH 50mm LENS.* Captured images from the Welch Allyn and MedRx systems using composite (MedRx) and S-video (Welch Allyn) output. The aperture on a 50mm lens attached to the CCD camera was varied from f/32 (least light) to f/11 (moderate light) to f/2.8 (most light). An image could not be obtained on the MedRx unit in this configuration at f/2.8 because the output from the MedRx camera was completely saturated. The lens could not be coupled to either the VCOM or the JEDMED unit (see above). The captured images shown here are Test Images #16, #17 and #18 previously described in the table entitled *TEST IMAGE LIST.*

- *GAIN CONTROL WITH PROBE.* Captured images from the Welch Allyn, MedRx and JEDMED systems using composite (MedRx and JEDMED) and S-video (Welch Allyn) output. The otoscope probe was focused on a test pattern with the otoscope light set at full intensity (labeled "*Initial Image*"). A larger test pattern was then used (labeled "*Distant Image*") and was positioned to generate a similar image to the "*Initial Image*" (hence distant to view the larger test pattern). A smaller test pattern was then used (labeled "*Closer Image*") and was positioned to generate a similar image to the "*Initial Image*" (hence closer to view the smaller test pattern). An image could not be obtained on the MedRx unit in the latter configuration because the output from the MedRx camera was completely saturated. Images could not be obtained from the VCOM unit due to insufficient lighting. The captured images

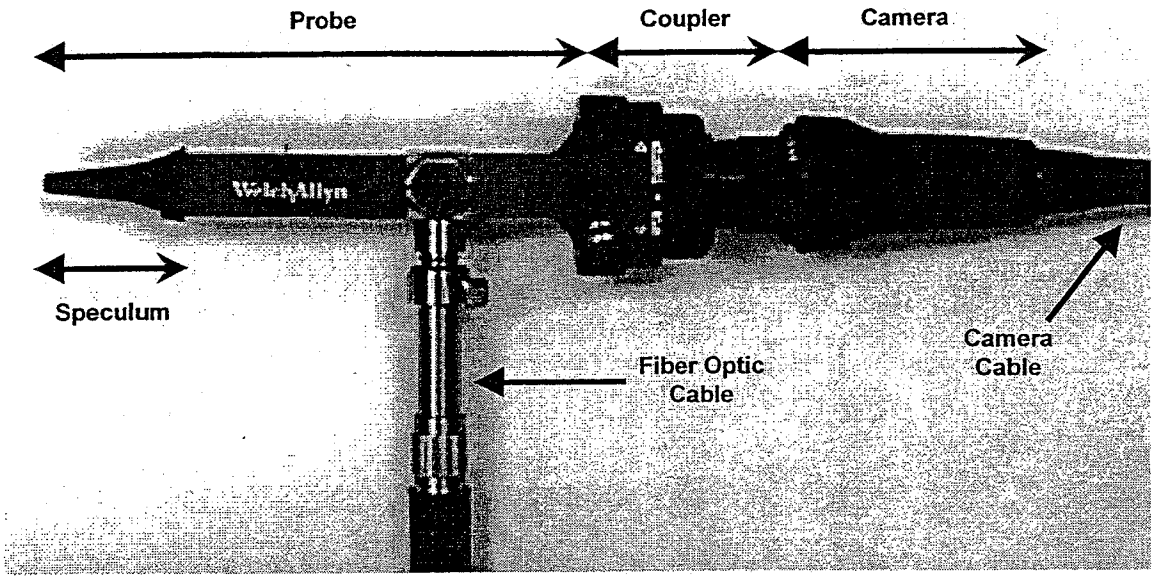
shown here are Test Images #3, #4 and #5 previously described in the table entitled *TEST IMAGE LIST.*

- *BLOOMING.* Captured images from the Welch Allyn, MedRx and VCOM systems using composite (MedRx and VCOM) and S-video (Welch Allyn) output. The otoscope probe was focused on a small reflective portion of the Macbeth ColorChecker Chart with the otoscope light set at full intensity (labeled "*Full Light*") and set at half intensity (labeled "*Half Light*"). An image could not be obtained on the VCOM unit using half intensity due to insufficient lighting. Images were not obtained using the JEDMED unit. The captured images shown here are Test Images #54 and #55 previously described in the table entitled *TEST IMAGE LIST.*

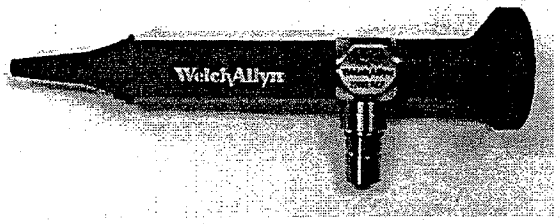
- *COLOR ACCURACY - WELCH ALLYN (AMD).* Captured images of the Macbeth Color Checker chart using the Welch Allyn system with a 50mm lens attached to the CCD camera. Upper image shows a scanned image of the Macbeth chart. Center images were obtained with the 50 mm lens set at f/2.8 (full open) using illumination on the chart from a 3200K (250W) incandescent bulb, with the Welch Allyn system color reset for 3200K illumination (left image) and color reset for the internal 5500K illumination of the system (right image). Note the change in color accuracy when the system is balanced for the wrong temperature of white light. Lower images were obtained with the 50 mm lens set at f/11 (less light) with the Welch Allyn system color reset for 3200K illumination, using illumination on the chart from a 3200K (250W) incandescent bulb (left image) and illumination from a 75W regular incandescent bulb (right image). Note the color accuracy is maintained when using a much dimmer source of illumination and a much tighter aperture. The captured images shown here are Test Images #30 (center left), #43 (center right), #32 (lower left) and #37 (lower right) previously described in the table entitled *TEST IMAGE LIST.*

- *COLOR ACCURACY - MedRx Inc.* Captured images of the Macbeth Color Checker chart using the MedRx system with a 50mm lens attached to the CCD camera. Upper image shows a scanned image of the Macbeth chart. Center images were obtained with the 50 mm lens set at f/2.8 (full open) using illumination on the chart from a 3200K (250W) incandescent bulb, with the MedRx system set to "Auto" white balance (left image) and "Lamp" white balance (right image). Note the change in color accuracy when the system is incorrectly white balanced. Lower images were obtained with the 50 mm lens set at f/11 (less light) with the MedRx system set to "Auto" white balance, using illumination on the chart from a 3200K (250W) incandescent bulb (left image) and illumination from a 75W regular incandescent bulb (right image). Note the color accuracy suffers when using a much dimmer source of illumination and a much tighter aperture. The captured images shown here are Test Images #30 (center left), #46 (center right), #32 (lower left) and #37 (lower right) previously described in the table entitled *TEST IMAGE LIST.*

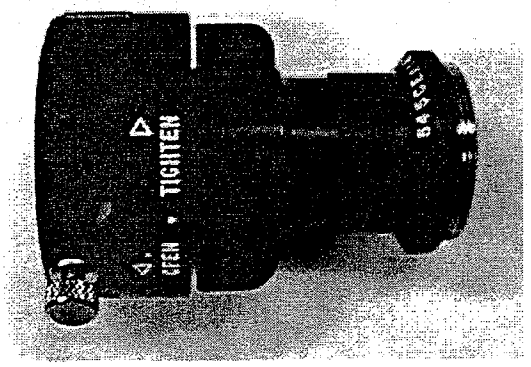
WELCH ALLYN OTOSCOPE HEAD



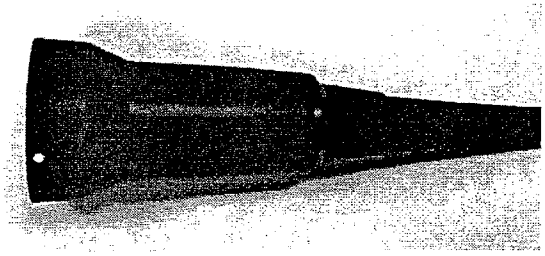
ENT Probe



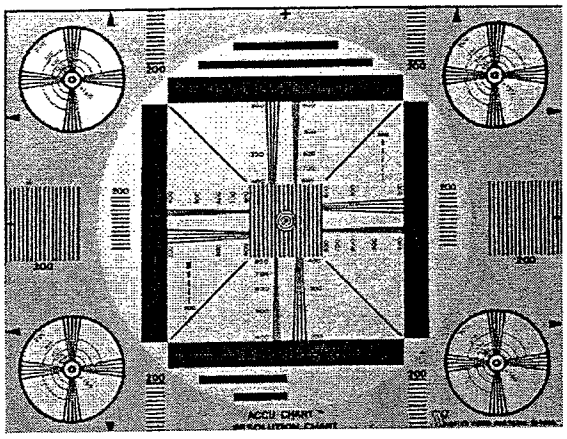
Coupler



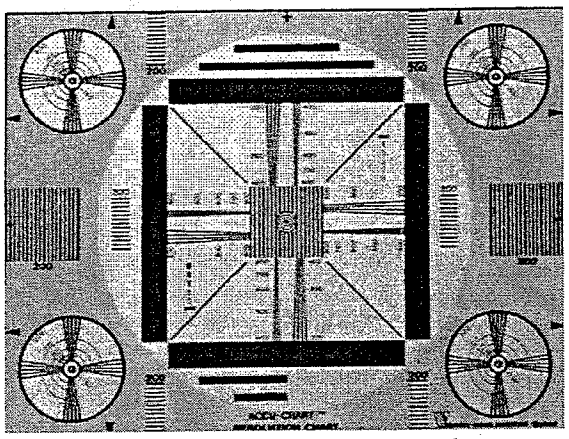
Camera



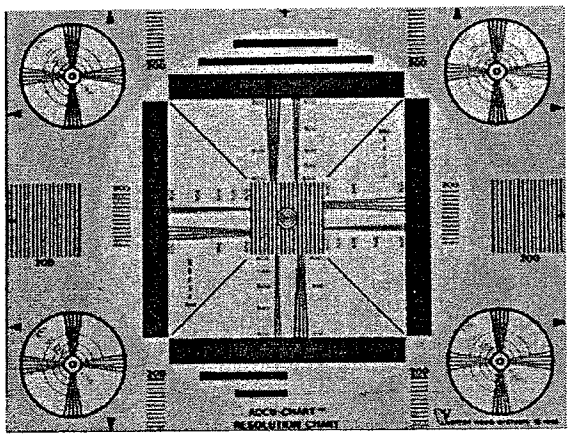
RESOLUTION WITH 50MM LENS



Welch Allyn (AMD) S-Video

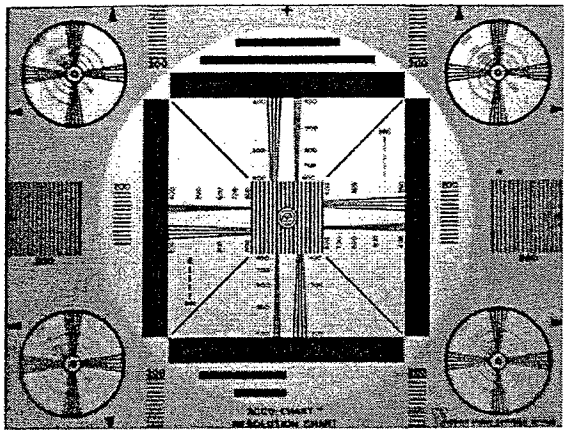


Welch Allyn (AMD) Composite Video

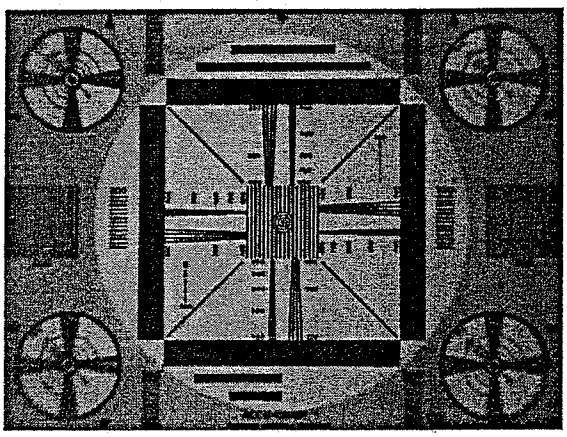


MedRx Inc.

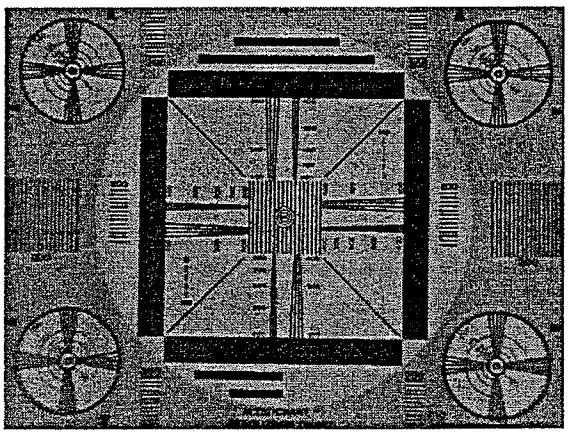
RESOLUTION WITH COUPLER



Welch Allyn (AMD) Bright Light

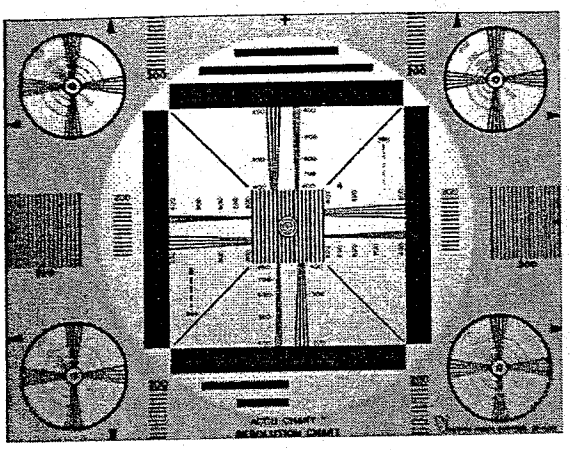


JEDMED Bright Light

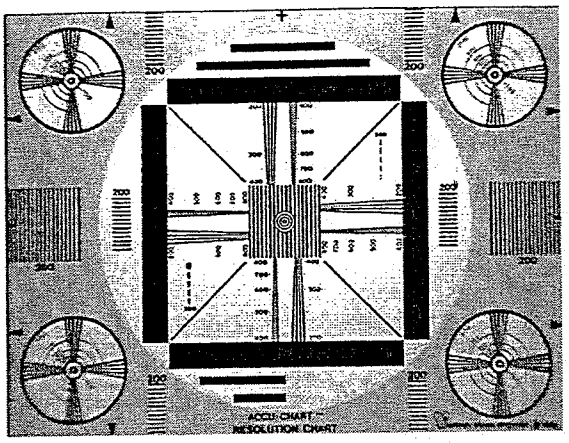


VCOM Systems

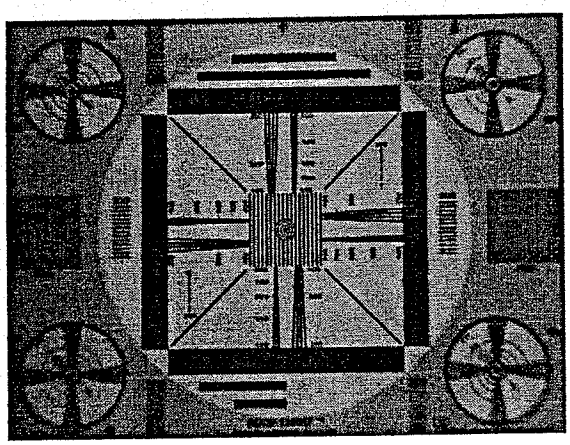
FACTORS AFFECTING RESOLUTION



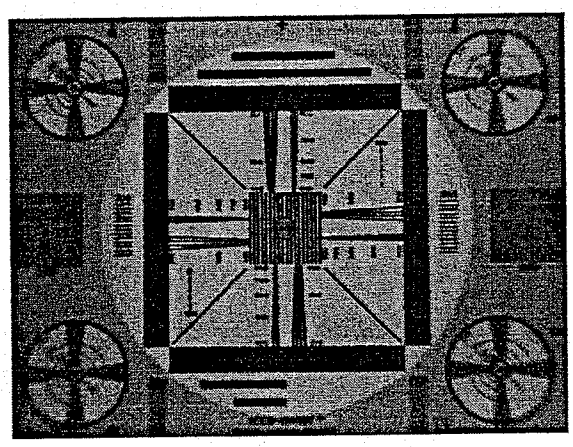
Welch Allyn (AMD) Bright Light



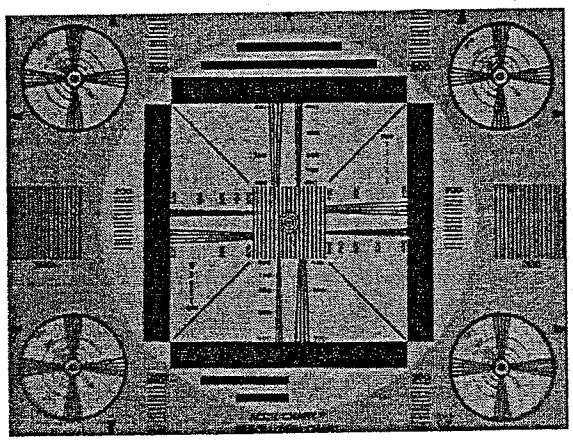
Welch Allyn (AMD) Bright Light with Image Enhancement



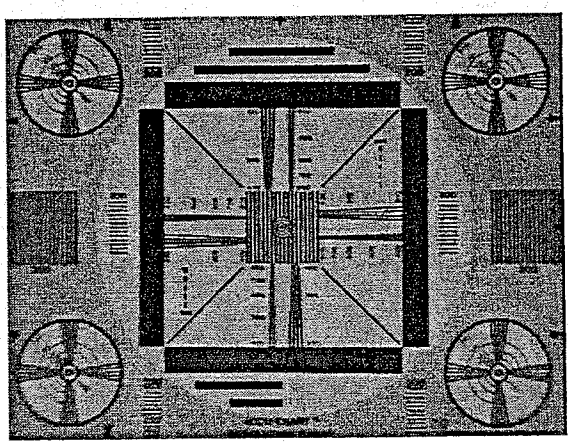
JEDMED S-video



JEDMED Composite video

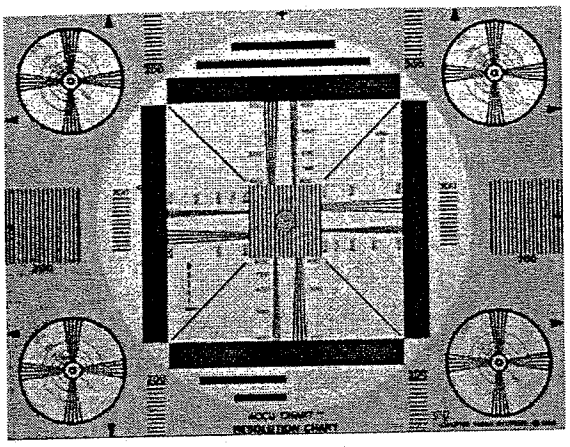


VCOM Systems S-video

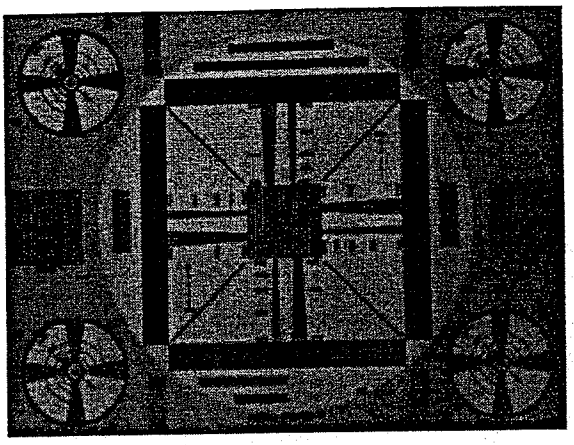


VCOM Systems Composite video

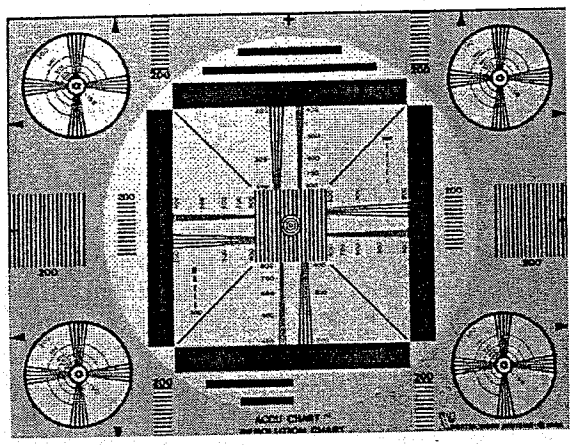
GAIN CONTROL WITH 50MM LENS



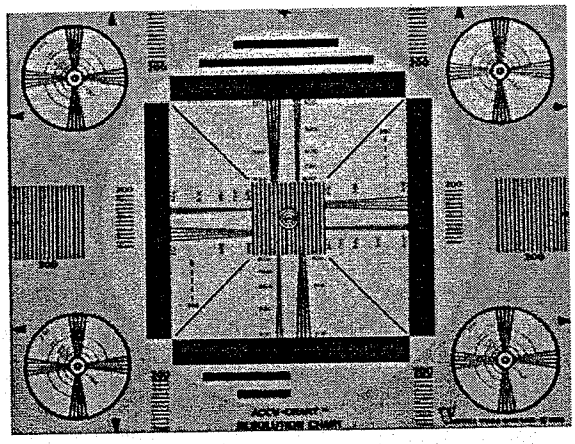
Welch Allyn (AMD) f/32



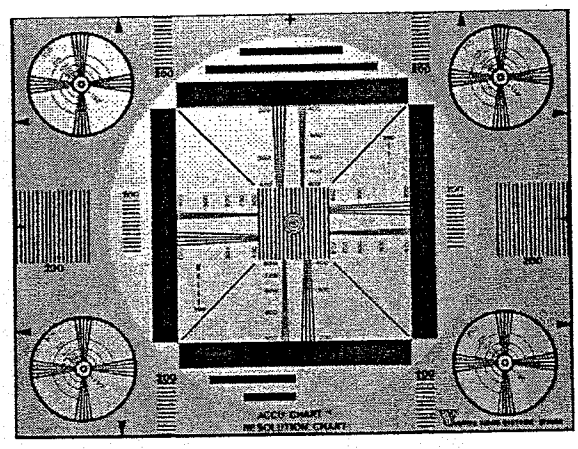
MedRx Inc. f/32



Welch Allyn (AMD) f/11



MedRx Inc. f/11

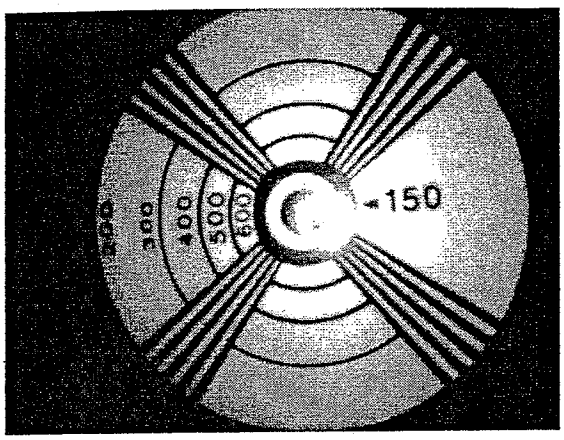


Welch Allyn (AMD) f/2.8

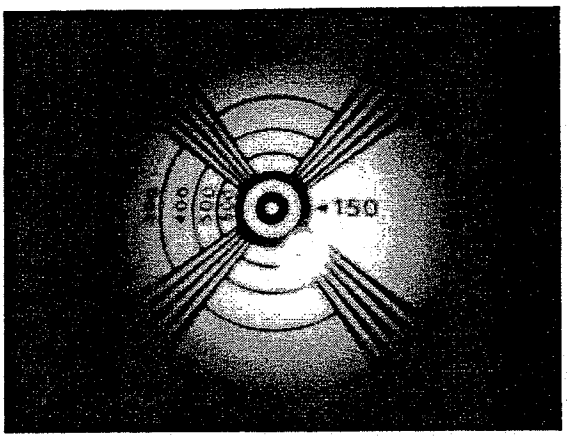
Image Not Available

MedRx Inc. f/2.8

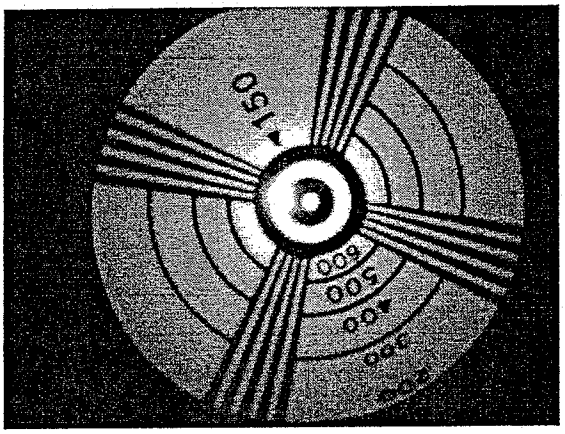
GAIN CONTROL WITH PROBE (PART 1 OF 2)



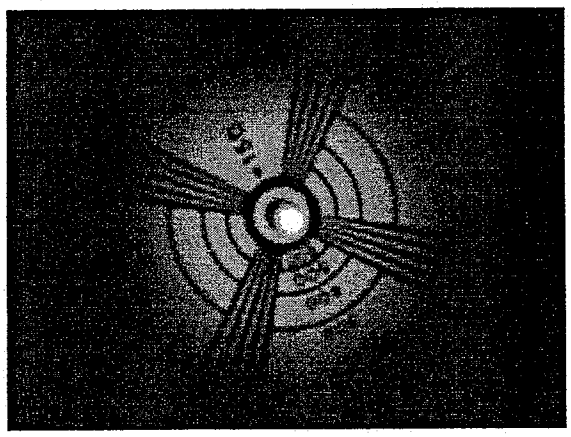
Welch Allyn (AMD) Initial Image



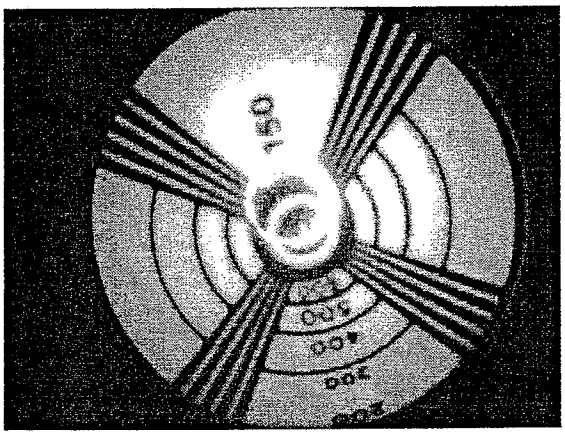
MedRx Inc. Initial Image



Welch Allyn (AMD) Distant Image



MedRx Inc. Distant Image

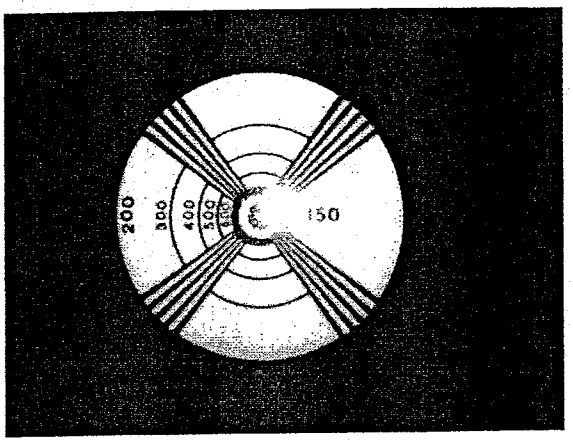


Welch Allyn (AMD) Closer Image

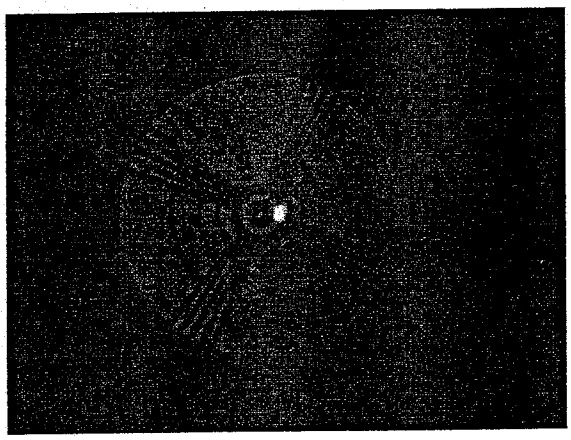
Image Not Available

MedRx Inc. Closer Image

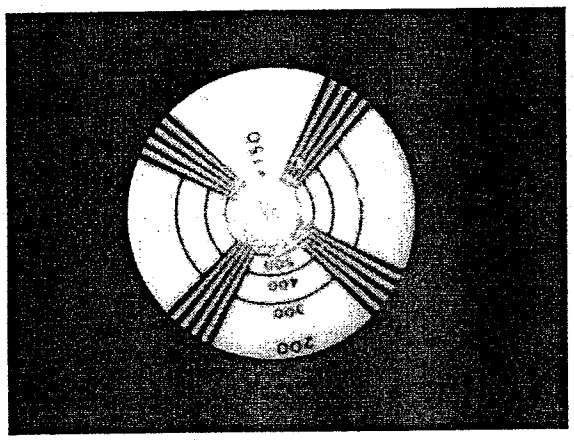
GAIN CONTROL WITH PROBE (PART 2 OF 2)



JEDMED Initial Image

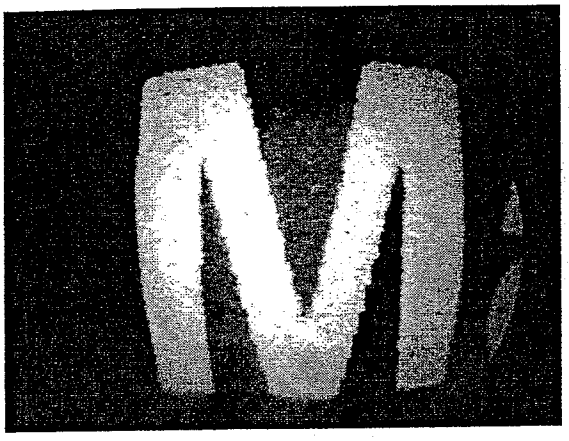


JEDMED Distant Image

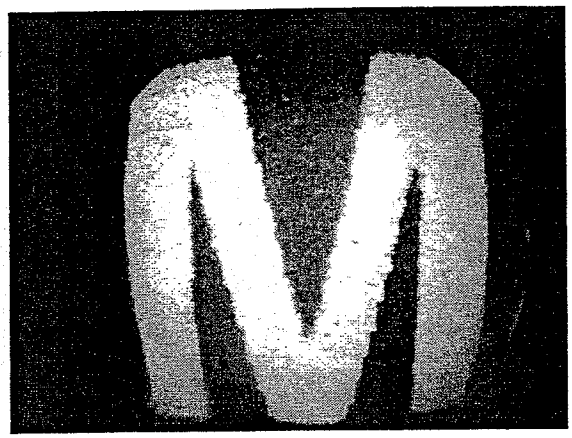


JEDMED Closer Image

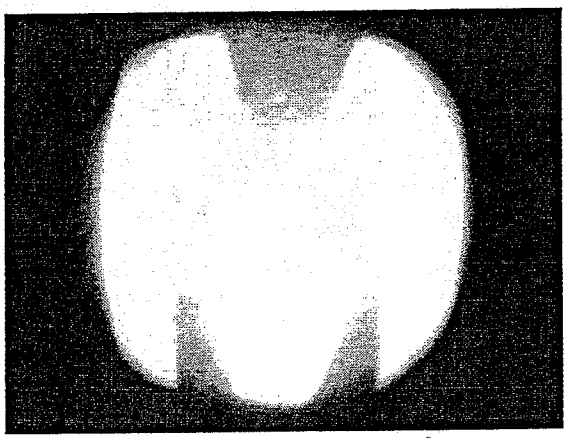
BLOOMING



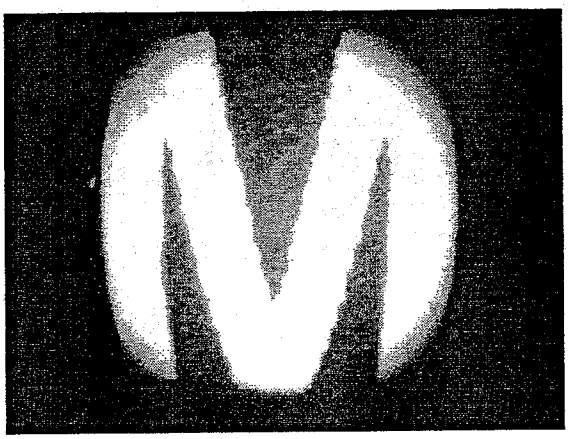
Welch Allyn (AMD) Full Light



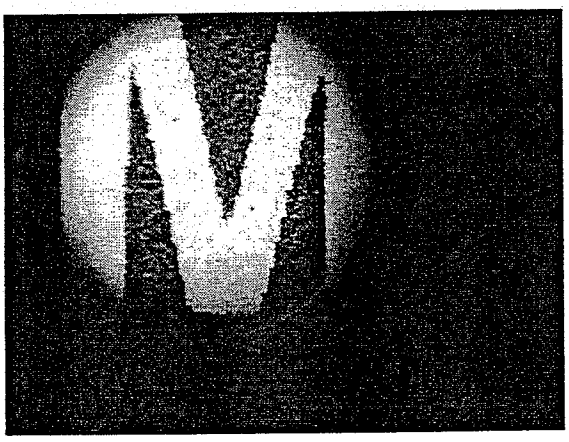
Welch Allyn (AMD) Half Light



MedRx Inc. Full Light

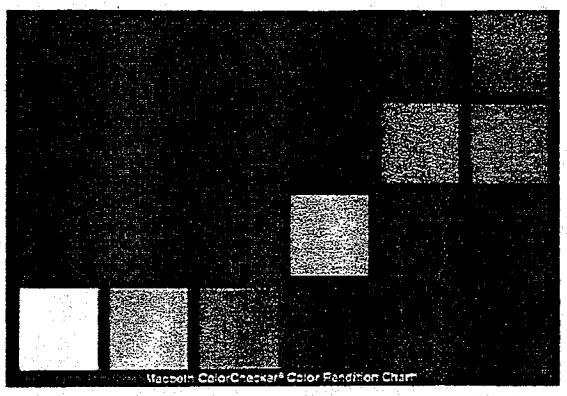


MedRx Inc. Half Light

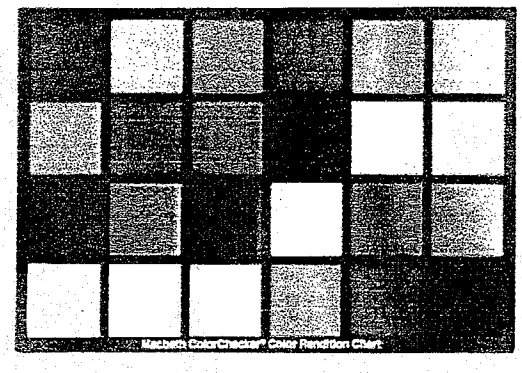


VCOM Full Light

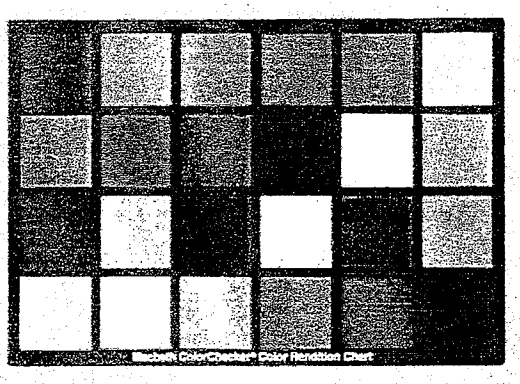
COLOR ACCURACY – WELCH ALLYN (AMD)



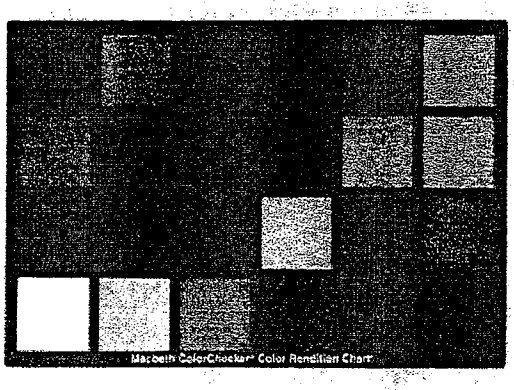
MacBeth ColorChecker Chart



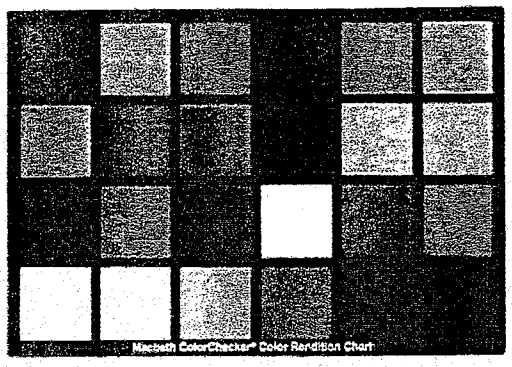
3200K Source, Balanced for 3200K, f/2.8



3200K Source, Balanced for 5500K, f/2.8

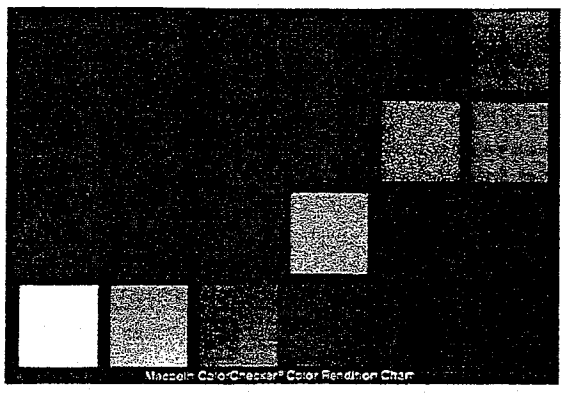


3200K Source, Balanced for 3200K, f/11

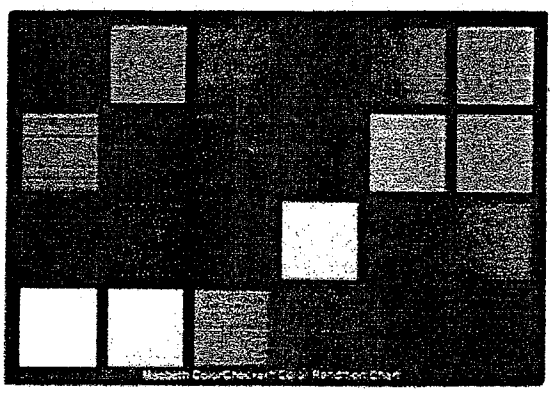


75W Incandescent Source, Balanced for 3200K, f/11

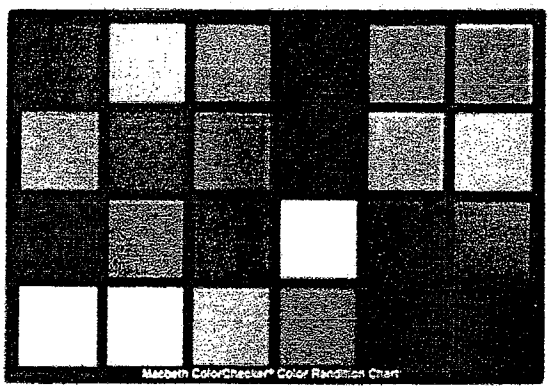
COLOR ACCURACY – MEDRX INC.



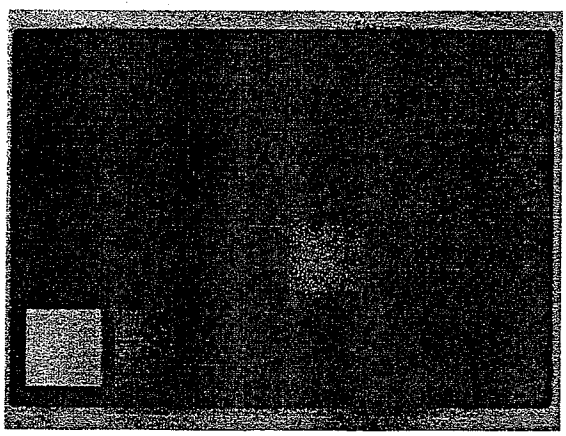
MacBeth ColorChecker Chart



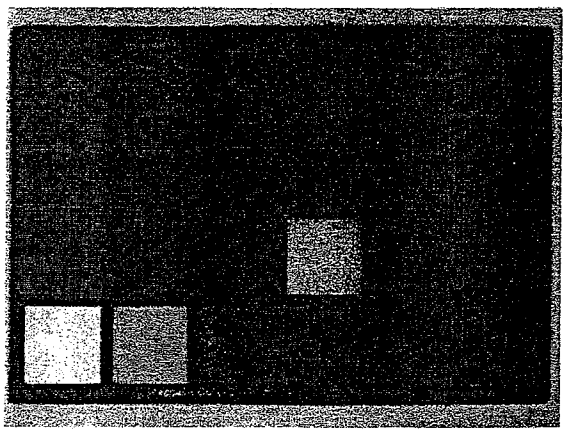
3200K Source, "Auto" Balance, f/2.8



3200K Source, "Lamp" Balance, f/2.8



3200K Source, "Auto" Balance, f/11



75W Incandescent Source, "Auto" Balance, f/11

List of Tables

These tables are included on the following pages:

- *RESULTS: RESOLUTION.* Table of results for the tested resolution of the CCD and electronics using both a 50mm lens attached to the camera and using the coupler supplied by the manufacturer. The field of view obtained during these tests is indicated for both the 50mm lens and the coupler. The manufacturer's specifications are also included for comparison. (Note: missing data indicates the data was not obtained during the test, "*n/a*" indicates the image was not captured and is *not available*.)

- *RESULTS: GAIN CONTROL.* Table of results for the tests on gain control and blooming. (Note: missing data indicates the specification was not available.)

- *RESULTS: COLOR ACCURACY.* Table of results for the tests on color accuracy.

RESULTS: RESOLUTION

Feature	Welch Allyn (AMD)	JEDMED	MedRx	VCOM Systems
Calculated Resolution Using 50mm Lens				
Lines of Resolution (S-video)	455h x 350v	n/a	n/a	n/a
Lines of Resolution (composite video)	325h x 325v	n/a	358h x 325v	n/a
Calculated Resolution Using Coupler				
Lines of Resolution (S-video)	423h x 325v	488h x 325v	n/a	488h x 325v
Lines of Resolution (composite video)		358h x 325v	n/a	358h x 325v
Lines of Resolution (S-video) with image enhancement	488h x 325v	n/a	n/a	n/a
Manufacturer's Specifications				
CCD specs	1/2" 380K pixels (768h x 494v)	unknown	1/3" 420K pixels	1/2" 380K pixels (768h x 494v)
Claimed Lines of Resolution	greater than 470 lines	500 lines	450h x 420v	greater than 470h x greater than 350v
Field of View Using 50mm Lens				
Field of View distance (in.)	31.4	n/a	31.4	n/a
Field of View horizontal (in.)	4.3	n/a	4.3	n/a
Field of View horizontal angle (deg.)	7.7	n/a	7.7	n/a
Field of View vertical (In.)	3.3	n/a	3.3	n/a
Field of View vertical angle (deg.)	5.9	n/a	5.9	n/a
Nearest Focus	1.75"	n/a	1.75"	n/a
Farthest Focus	infinite	n/a	infinite	n/a
Field of View Using Coupler				
Field of View distance (in.)	31.4	20.8	n/a	
Field of View horizontal (in.)	4.3	4.3	n/a	
Field of View angle (deg.)	7.7	11.7	n/a	
Field of View vertical (in.)	3.3	3.3	n/a	
Field of View angle (deg.)	5.9	9.0	n/a	
Nearest Focus	10.25"	12"	n/a	
Farthest Focus	infinite	infinite	n/a	

RESULTS: GAIN CONTROL

Feature	Welch Allyn (AMD)	JEDMED	MedRx	VCOM Systems
Calculated Resolution Using 50mm Lens				
Gain Control with Lighting	Extremely good. Adapts to all lighting conditions with no need to adjust light intensity. Reacts quickly to sudden changes.	Fairly good adaptation to light - but seems to lose color accuracy at high brightness.	Poor - unable to adjust to wide range of lighing conditions. Needs manual adjustment of light source.	Electronics has user-selectable gain control, as well as automatic and "up" setting (for darker condtions). Quite good, adapts quickly except when using closed-off speculum (images 56,a-c).
Blooming	None observed with either S-video or composite video.	None observed with either S-video or composite video.	Clearly some blooming, or at least poor gain control.	No blooming, but poor gain control.
Manufacturer's Specifications				
Claimed Minimum Illumination			5 lux	
Shutter	Infinitely variable electronic auto-shutter.			Electronic auto-shutter, with optional fixed shutter speed (1/60 ~ 1/10000) and synchronized scan.

RESULTS: COLOR ACCURACY

Feature	Welch Allyn (AMD)	JEDMED	MedRx	VCOM Systems
Results				
Color accuracy	Seems very good. Large yellow shift when changing from 5500K to room light, but is corrected using the "Color Reset" switch. Very good color accuracy with low intensity of illumination.	Seems washed out at bright light.	Poor color accuracy at low illumination. Very good color accuracy at high illumination. Need to use the "auto" position for all light sources tested, otherwise see blue shift when using "bulb" position.	Not tested.
Response to changing the intensity of the system's light source.	Adjusting light intensity seems to adjust an aperature rather than adjusting the light output of the bulb - maintaining constant wavelength over entire range. Color accuracy unaffected.	Dimming light causes red shft in output.	Dimming light causes red shift in output.	Not tested.
Color Settings				
White Balance	One button setting.	Has manual adjustment, "auto" mode, and "auto set".	No reset. Has manual adjustment, "auto" mode, and "bulb".	One button setting. Option for automode (covers range of 2500-7000K) and manual adjustment.

Testing Optics

Introduction

Video otoscopes rely on small optical pathways to project an image of the tympanic membrane on the CCD sensor of the attached video camera. The Welch Allyn otoscope, for example, consists of a long narrow solid rod lens with length of 70 mm but a diameter less than 2.7 mm. The image projected onto the camera is severely affected by the optics of this pathway due to the distortion, clarity, and resolution of the lens. The lens design also determines salient features of the video otoscope, including the size of the image that may be projected (field of view), the distance at which the image may be properly focused (depth of field), and the amount of light required to project an image.

Field of View

It is desirable that any otoscope be capable of capturing an image of the entire tympanic membrane. This is particularly important in a telemedicine application using store-and-forward technology, because a single image can then be captured and transmitted for diagnostic purposes. If only a portion of the membrane can be captured, then multiple images must be captured, stored and forwarded instead of a single image. The "right" field of view would allow the probe to be inserted into the ear and allow the tympanic membrane to fill "most of" the captured image. Moving closer or farther away from the membrane would decrease or increase the size of the membrane in the image respectively. An otoscope with a field of view deemed "too small" would prohibit the entire membrane from being captured in a single image; each image would only be capable of capturing a portion of the membrane. A field of view deemed "too large" would allow the image to capture the entire membrane, but the membrane would represent only a small portion of the image and have less detail than desired.

Field of view is limited by two separate factors. The most critical is the view angle at the tip of the otoscope probe. This angle determines the viewable area that may be projected onto the CCD sensor in the camera. However, apertures within the optical pathway of the probe may truncate this viewable area. An obvious example is the placement of an aperture (literally a plat with a small hole) between the probe and the camera; such an aperture may be used to "sharpen" the picture but will also mask the outer portions of the image from reaching the CCD sensor. It is desirable that the image projected by the otoscope optics not be cropped while filling the largest possible area of the CCD sensor in order to provide the greatest detail in the captured image. In reality, the otoscope optics usually projects a "circular" image on the "rectangular" shaped CCD sensor, so a portion of the CCD sensor will not receive any image. Noting that each captured image contains 640 (horizontal) by 480 (vertical) pixels (for a total of 640×480 = 307,200 pixels), then an uncropped circular otoscope image is limited to a radius of 240 pixels to remain completely on the CCD sensor. This means that an uncropped image can occupy no more than 180956 pixels (= π×240×240) or 58.9% of the CCD sensor.

Field of view was calculated by determining the size of an image that could be captured by the otoscope probe at a fixed distance. A "bullseye" image was centered below each probe at a distance of 29.4 mm, and the radius of the image was measured. When possible, a variety of apertures and couplers were tested with each system. Captured images for each otoscope system are shown in the figure entitled *FIELD OF VIEW*. The measurements obtained from these images, and the calculated fields of view, are listed in the table entitled *RESULTS: FIELD OF VIEW*.

The Welch Allyn probe exhibited the largest field of view at the tip of the probe at 76° -- the exact value specified by the manufacturer. The JEDMED probe exhibited a similar degree of magnification as the Welch Allyn probe (see figure -- meaning that the image of the bullseye rings were the same size), but the image was "cropped" and therefore represented a smaller field of view at 44°. The MedRx short probe, without any apertures installed, matched the Welch Allyn probe for a 76° field of view. Using an aperture in the probe reduced the field of view to 71°, and using an aperture in the camera reduced this further to 59° or 60° for the short probe. These values agree with the MedRx's claimed range of 55° to 70°. VCOM Systems attained the lowest angle of view at 14°, independent of the use of their 2x extender. The only effect of the 2x extender was to enlarge the image projected on the CCD sensor, but it did not change the optical field of view.

The actual projected area of the otoscope image on the CCD sensor varied greatly between systems (see figure entitled *FIELD OF VIEW* and table entitled *RESULTS: FIELD OF VIEW*). The Welch Allyn system and the MedRx short probe achieved the largest image projections, both producing an image that was almost perfectly centered on the CCD sensor and filled the CCD sensor top to bottom. The resultant images filled 58.9% of the sensor surface, equal to 100% of the theoretical best possible value. The MedRx long probe filled a slightly smaller area of the sensor, occupying 46% of the area -- equivalent to 78% of the theoretical best value. The image produced by the JEDMED system was also centered on the CCD sensor, but filled a much smaller portion of the sensor (27.7%). This value represents only 47% of the theoretical best value. VCOM Systems produced an image that filled 36% and 12.2% of the sensor area with the 2x extender on and off respectively. This represents 61% and 21% respectively of the theoretical best value. The presence of a speculum on the VCOM probe further cropped the image projected through the optical path, reducing the captured image size to a miniscule 2.6% of the CCD sensor area when using a 2.5 mm speculum without the 2x extender. Overall, the use of a 2.5 mm speculum reduced the effective image size by 77% for the VCOM probe.

Focus and Illumination

Generally, a trade-off exists in any optical system whereby the depth of field in inversely related to the brightness of the image. This is because the depth of field depends on the aperture -- a variable-sized opening that restricts the amount of light projected through the system. A wider aperture permits more light and creates a brighter image, but reduces the depth of field. A narrower aperture reduces the amount of light but increase the depth of field.

The otoscope systems do not directly open and close an aperture within the camera, yet we noticed the image became blurred as the illumination intensity decreased. The image appeared to lose focus and definitely lost resolution. One possible source for this effect is the gain control circuitry that attempts to boost the output signal with a subsequent loss in image contrast.

This effect is shown for each otoscope system in the figure entitled *FOCUS AND ILLUMINATION*. The otoscope system was focused (when possible) on a test pattern positioned 1" from the tip of the otoscope probe, and the inherent illumination in the otoscope system was set at full brightness, half brightness and quarter brightness. The captured images were clearly darker as the illumination was reduced, and the image lost focus.

All otoscope systems exhibited a range over which the objects remained in focus; the range was less for low light conditions and greater for bright light conditions. Since these systems would probably be used in a clinical setting with their inherent illumination set to its maximum level, the depth of field (see next section) was tested using the inherent illumination set at maximum brightness. Clearly, this test favors systems with brighter light sources, but these systems would also exhibit greater depth of field in a clinical setting.

Focus and Depth of Field

Otoscope systems are equipped with either a fixed focus or a manual focus control. A manual focus control has the advantage of allowing the user to focus on an object over a range of distances from the probe tip, but has the disadvantages of adding another control that the user must adjust -- and which may be improperly adjusted. In either case, once the focal point is set, the probe will produce a focused image over a range of object distances - termed the depth of field. Ideally, the image will be focused over a large range of object distances, and the manual adjustment would rarely be used.

The depth of field was "qualitatively" determined using a series of pattern tests, all conducted using the illumination system set to full intensity. Initially, the otoscope was focussed (if manual focus was available) on a 16 mm diameter bullseye pattern. The distance from the probe to the pattern was adjusted until the pattern completely filled the field of view generated by the otoscope system. A larger 77 mm diameter bullseye pattern was then substituted for the initial 16 mm diameter test pattern. The otoscope probe was moved farther away from this pattern until the image completely filled the field of view -- without any adjustment to the focus. The extent to which this pattern, located farther away, remained in focus provides a qualitative sense of the distal depth of field. A smaller 9 mm diameter bullseye pattern was then used as the test pattern. The otoscope probe was moved closer to this pattern until the image completely filled the field of view -- still without any adjustment to the focus. The extent to which this closer pattern remained in focus provides a qualitative sense of the proximal depth of field.

These tests could not be conducted on the VCOM systems otoscope probe because the narrow angle of view prevented the entire bullseye pattern being imaged. Instead, the otoscope probe was focused on a very small (5 mm diameter) bulls eye pattern at a distance of 3.2 mm for the "Initial" image. The pattern was moved farther away (to a distance of 6.4 mm) and the image was captured with no adjustments made to the focus control. No attempt was made to measure the depth of field with a pattern closer than 3.2 mm.

The "qualitative" results are shown in the figure entitled *DEPTH OF FIELD*. Two systems with manual focus controls (Welch Allyn and JEDMED) exhibited excellent depth of field, producing sharp images with the distant and closer patterns. The Welch Allyn system exhibited excellent gain control such that all the images appeared similarly bright, whereas the JEDMED system produced noticeable darker images for distant patterns, and brighter (washed out) images for closer patterns. The MedRx system uses a fixed focus with no manual control, but exhibited a fairly good depth of field. The short probe was more out of focus with the distant pattern compared to Welch Allyn and JEDMED, but all other images were well focused using the short probe or the long probe. The VCOM system uses such poor lighting that the initial image is difficult to see, and the distant image is very much out of focus. The illumination system for the VCOM system is much weaker than the other systems tested, and the depth of field is similarly less.

A more quantifiable comparison of the depth of field was obtained by determining the distance over which a pattern remained "in focus" -- without requiring additional manual focus. The results, and the manufacturer's claimed depth of field, are shown in the table entitled *RESULTS: DEPTH OF FIELD*. The JEDMED equipment exhibited the largest range, producing clear images of a test pattern whose position was varied from closer than 1/4" to greater than 1.5" from the tip of the otoscope probe. This means that once the focus is properly set on such a system, any objects within this distance of the probe tip will appear in focus without further manual intervention. The Welch Allyn equipment exhibited the second largest range, producing clear images of a test pattern whose position was varied from closer than 1/4" to greater than 1" from the tip of the otoscope probe. The MedRx system had a range of 1/4" to less than 1" for the long probe, but a smaller distance (1/4" to 1/2") for the short probe. The VCOM system had the narrowest range of focus (1/4" to 3/8").

It should be noted that these quantified ranges are consistent with the qualitative results. Both the Welch Allyn and JEDMED systems produced large depths of field, the MedRx short probe could not focus on more distal objects, and the VCOM system had a very limited depth of field.

None of the manual focus adjustment mechanism were without problems. The Welch Allyn manual adjustment is a large ring located on the coupler attachment and is too clumsy and stiff to manipulate when using the otoscope. Once the focus is set, it tends to stay set because the ring is so stiff. The JEDMED system uses a barrel ring that the user turns to change the focus. To move the focus from the most distal to the most proximal setting, the user must turn this barrel many times (not just once). This means the user may not always simply use a quick flick with a thumb to change the focus. Moreover, slack in the mechanism means that a dead space exists when changing the direction of focus (termed "hysteresis"). This was disconcerting when the user "overstepped" the focus and had to reverse direction, requiring considerable turning of the barrel before any changes in focus occurred. The VCOM system uses a ring similar to Welch Allyn, but it was also difficult to turn while actually using the scope.

Distortion

The image output from each otoscope system is never an exact replica of the pattern used to generate the image. Distortion of the image occurs as a result of the probe optics. This occurs in addition to other distorting factors such as the limited resolution of the camera and electronics, pixelation effects of the CCD sensor, color aberrations, and focus concerns. Unlike these other effects, some distortion is inevitable and necessary. This is due to the need for the probe to capture a "wide angle view" of the object (clinically this would be the tympanic membrane). Without this wide angle, the probe would not be capable of capturing the entire object in the field of view.

The distortion associated with a wide-angle lens is typically referred to as "barrel" distortion. The effect is to make straight lines in the object appear as "bowed" lines in the image output, resembling the edge of a barrel or cask. An ideal lens would produce symmetric barrel distortion, where the effect would be uniform at any points equidistant from the center of the image.

Other distortions introduced by the optical pathway are not desirable, and reflect upon the quality of the lens design and manufacture. Examples include asymmetric barrel distortion (where the distortion is more pronounced in some regions of the image) and uneven images (where the pattern cannot be properly centered in the image).

Distortions are not limited to the optical pathway, and may also show up in the illumination system. A narrow path of illumination (that is not matched to the angle of view of the probe) would produce darker, poorly lit regions at the periphery of the image. A poorly centered path of illumination would shift the overall illumination from the center, and create a darker periphery at one side of the image.

No quantitative tests for distortion were conducted. Instead, qualitative results were obtained using images of test patterns (with straight lines) and bullseye patterns (with curved lines). The captured images are shown in the figure entitled *DISTORTION*. An example of the expected and acceptable barrel distortion is shown in the top left image (Part 1 of 2) using the Welch Allyn equipment. Here, distortion appears to be uniform throughout the image and around the circumference. The center of the pattern is centered in the image, and an equal border is produced at the periphery. The light output is also centered in the image and appears uniform over the entire image with minimal drop-off at the periphery. Similar results were obtained using the bullseye pattern for this equipment (top right, Part 1 of 2). The results obtained using the JEDMED system were similar, showing little or no aberrant distortion and uniform illumination.

The VCOM system produced no noticeable barrel distortion in the image, principally due to the much narrower angle of view associated with this equipment. Without the wide-angle nature of the other otoscopes, this system managed to produce a "flat" image. However, the pattern was usually off-centered in the final image, simply due to misalignment of the components (beam splitter, optics, camera, etc.) in the optic pathway. The illumination pattern of the inherent light tended to be dim at the periphery.

The MedRx probes produced the most significant distortion of all probes tested. Both the short and long probes produced images that were off-centered. Attempting to center the pattern in the image resulted in an asymmetric periphery, with more of the image being displayed on the left side of the image (see Part 2 of 2, left images). Attempting to align the periphery of the bullseye pattern with the periphery of the image resulted in images that appeared off-centered (see Part 2 of 2, right images). The illumination of the short probe was less uniform than the other probes, appearing darker at the periphery than other illumination systems. The long probe was the most asymmetric in terms of lighting and field of view, which was to be expected because that probe also has an irrigation channel running the length of the probe. This means that the optic pathway is not concentric with the illumination pathway, but shares the center of the probe with the irrigation channel and lies off-center. This can be seen in the reflection of the probe tip in the lower left image (Part 2 of 2), showing two dark circles representing the optic pathway and irrigation channel lying inside the bright fiber bundle.

Resolution of System

An otoscope system with "perfect" optics would have a resolution limited only by the camera and electronics. However, imperfections in the optics are introduced by factors such as the lens quality, lens coatings, lens alignment, and the manufacturing process. The overall resolution of the entire system is therefore a combination of the limitations imposed by each of the components.

These tests were conducted to determine the lines of resolution provided by the entire system: the probe, camera and electronics. Similar to the tests conducted on the camera and electronics, it was desirable to determine the "lines of resolution" in both the vertical and horizontal direction. It was recognized that barrel distortion (see preceding section) would severely affect the resolution calculation, depending upon the resolution being calculated at the center or periphery of the image. Note that all resolution measurements were made using the portion of the image closest to the center, and are reported as "resolution near center".

The original plan was to determine the resolution by focussing (when possible) the probe on a test pattern -- from which the "lines of resolution" could be determined. However, this was only possible for the Welch Allyn system. The JEDMED system produced an inadequate light output to illuminate the test pattern, the MedRx unit had a limited depth of field and required the test pattern to be located so close that the entire pattern was not seen, and the VCOM system had such a limited field of view that the test pattern was not seen in its entirety. The test was modified for these systems. The MedRx system, without manual focus, was positioned close to a smaller test pattern such that most of the pattern was within the focal range of the probe (see earlier section entitled "*Focus and Depth of Field*"). Both the JEDMED and VCOM systems were tested with only a portion of the test pattern -- either the left edge or the top edge that contained horizontal and vertical line patterns respectively. For all the systems, the actual lines of resolution near center were extrapolated based on the portion of the test pattern observed in the image

The captured images are shown in the figure entitled *RESOLUTION OF SYSTEM.* These images were studied to determine the limit at which lines on the resolution patterns could no longer be discerned. The results are shown in the table entitled *RESULTS: RESOLUTION OF SYSTEM.* The values are shown as having an uncertainty of +/- 10%, due to the extrapolation used in determining these numbers.

The Welch Allyn images (top left, Part 1 of 2) best show the original intent of these tests to capture the entire test pattern. The lines of resolution near center were 430 horizontal by 309 vertical (430h x 309v). The 10% uncertainty in these values places them close to, but slightly less, than the 455h x 350v resolution obtained without the probe but using the camera and electronics with a 50mm lens (see earlier section). The Welch Allyn system provides an "Image Enhancement" control on the main unit that "sharpens" the image-- presumably using a high-pass filter on the horizontal sweep. Similar to the effect noted earlier using the camera with only the coupler, the effect of this control on the image (middle left image) is to increase the horizontal resolution. The system resolution using image enhancement was 485h x 309v, which represents approximately a 10% improvement in the horizontal resolution with no affect in the vertical resolution (as expected). Similarly, using the composite video output (lower left image) instead of the S-video output drastically reduces the horizontal resolution, resulting in an overall system resolution of 337h x 322v. This is consistent with the resolution (325h x 325v) obtained without the probe but using the camera and electronics with a 50mm lens (see earlier section). This suggests that the resolution of the Welch Allyn system is not limited by the optics, but is limited by the camera and CCD sensor.

The MedRx system was tested with a smaller pattern positioned closer to the probe tip, but produced images (see left images on Part 2 of 2) similar to those obtained from the Welch Allyn equipment. The resulting resolutions of 347h x 243v for the short probe and 319h x 245v for the long probe were significantly lower than the resolution of the Welch Allyn equipment. The poorest (composite) video output from the Welch Allyn camera still produced a higher resolution than the MedRx equipment. The short probe produced a higher resolution image than the long probe, consistent with other tests that indicate the long probe has greater distortion. These values are slightly less than the 358h x 325v resolution obtained without the probe but using the camera and electronics with a 50mm lens (see earlier section). This suggests that the resolution of the MedRx system is limited by the optics of the probe.

The JEDMED system attained the highest resolution of all systems in these tests (476h x 273v). It should be noted that due to the poor illumination of this system, the patterns used for this test (see right images on Part 1 of 2) were considerably different from those used with other equipment. Consequently, it is unclear if the results can really be compared to other systems. A similar problem occurs when comparing the resolution calculated for the VCOM system (see right images on Part 2 of 2), although this system attained a poorer resolution of 370h x 195v.

Dot Resolution of System

The product of vertical lines of resolution and horizontal lines of resolution provides an estimate of the number of distinct "dots" that can perceived by an imaging system. However, the otoscope probe and other optical considerations "crop" the final output, such that only a portion of any test pattern is observable on the output image (see earlier section entitled "*Field of View*"). Consequently, the number of distinct dots that a system can image must be weighted by the viewable area of the system. For example, the Welch Allyn equipment supports 430h x 309v lines of resolution near center, but the resultant image only displays 58.9% of the original pattern. This system therefore has a "dot resolution" of 78K = 78,000 (= 430 × 309 × 0.589)

The results for such calculations are shown in the table entitled *RESULTS: DOT RESOLUTION OF SYSTEM*. The values shown have an uncertainty of +/- 20%, due to the extrapolation used in determining line resolution near center.

The Welch Allyn system provided the highest dot resolution of all systems tested, regardless of whether the S-video (78K) or composite video output was used (64K), and regardless of the use of the "Image Enhancement" feature (88K). Using the S-video output without any image enhancement, the Welch Allyn equipment provided 56% greater dot resolution than the next closest system (MedRx with short probe at 50K). The JEDMED system, which attained the highest resolution of all systems in these tests, attained one of the lowest dot resolution scores (36K)

because this system generates a very small image field, occupying only 27.7% of the output area compared to 58.9% for both the Welch Allyn and MedRx systems. VCOM Systems, through the combination of a small image output and poor resolution, attained the lowest dot resolution (26K) of all systems tested.

List of Figures

These figures are included on the following pages:

- *FIELD OF VIEW.* Captured images from all tested systems to determine the field of view of the otoscope probes. The "bullseye pattern" in photo #32 was centered at a distance of 29.4 mm from the tip of the otoscope probe. Most images show several "rings" of the bullseye pattern. The VCOM system exhibited higher magnification, with the image showing only the center light spot and the innermost black ring of the bullseye pattern. Images shown for the MedRx unit were taken without using an aperture on the Watek camera, but with an aperture on the small probe only. Additional images are shown on Part 2 of 2 for the MedRx unit using the small probe with various aperture options. The captured images shown on Part 1 of 2 are Test Image #1f (for VCOM Systems without 2x extender), #1e (for MedRx long probe), #1b (for MedRx short probe) and #1 (for Welch Allyn, JEDMED, VCOM Systems) previously described in the table entitled *TEST IMAGE LIST.* The captured images shown on Part 2 of 2 are Test Image #1b (top left), #1a (top right), #1d (bottom left) and #1c (bottom right) previously described in the table entitled *TEST IMAGE LIST.*

- *FOCUS AND ILLUMINATION.* Captured images from all tested systems to visualize the change in depth of field with varying levels of illumination. Each system was manually focussed (when possible) on a test pattern located 1" from the tip of the probe. Images were captured using the inherent illumination of the each otoscope system set to full, 1/2 and 1/4 intensity. The VCOM system was tested with AGC set to "ON". The captured images shown are Test Image #6 ("Full Light"), #7 ("1/2 Light") and #8 ("1/4 Light").

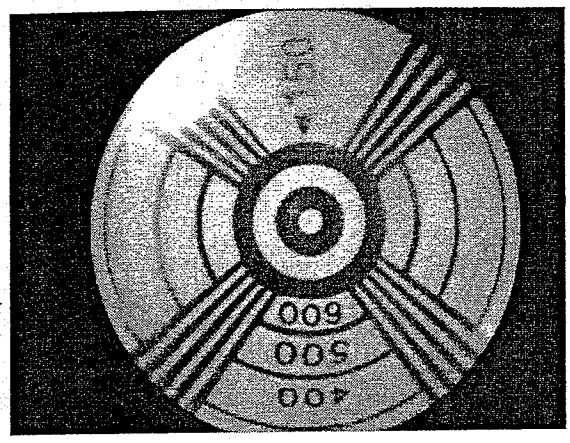
- *DEPTH OF FIELD.* Captured images from all tested systems to visualize the depth of field of the otoscope probes. Each system was manually focussed (when possible) on an initial bullseye pattern - termed "Initial Image" in this figure. A larger bullseye pattern was then used and positioned farther away without any further focussing; that captured image is termed "Distant Image" in this figure. A smaller bullseye pattern was also used and positioned closer without any further focussing; that captured image is termed "Closer Image" in this figure. These tests could not accomplished on the VCOM Systems unit, due to the much smaller angle of view. For this system, the scope was focussed on the smaller bullseye pattern positioned 1/8" from the otoscope; this formed the "Initial Image". That pattern was moved to a distance of 1/4" and the unit was not re-focussed before capturing the "Distant Image". The captured images shown for the Welch Allyn, JEDMED and MedRx short probe are Test Image #3 ("Initial Image"), #4 ("Distant Image") and #5 ("Closer Image"). The captured images shown for the MedRx long probe are Test Image #3a ("Initial Image"), #4a ("Distant Image") and #5a ("Closer Image"). The captured images shown for the VCOM Systems probe are Test Image #5b ("Initial Image") and #5c ("Distant Image").

- *DISTORTION.* Representative images captured from each system to indicate the distortion exhibited by each probe. An image is shown for a complete test pattern (left) and a bullseye pattern (right). The captured images for the Welch Allyn system are Test Image #14 (left) and #3 (right), for the JEDMED system are Test Image #14a (left) and #3 (right), for the VCOM system are Test Image #14a (left) and #5b (right), for the MedRx short probe are Test Image #14a (left) and #3 (right), and for the MedRx long probe are Test Image #14b (left) and #3a (right).

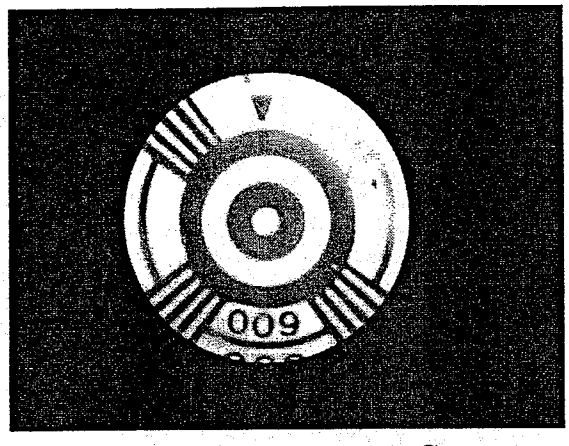
- *RESOLUTION OF SYSTEM.* Captured images from all tested systems to calculate the resolution of the entire system. When possible, a complete test pattern was positioned directly below the probe tip and positioned such that the pattern filled the image. Images are shown for this case on Part 1 of 2 using the Welch Allyn system in the standard configuration (top left), with image enhancement turned on (middle left), and using composite rather than S-video output (bottom left). For the JEDMED system, the poor inherent lighting produced a dark

image (top right) so the test pattern was moved closer to the probe tip resulting in close-ups of the left edge (middle right) and top edge (bottom right) of the test pattern that were used to extrapolate the resolution. The MedRx system, with a fixed focus, produced an out-of-focus image of the test pattern (Part 2 of 2, top left). A smaller test pattern was used which could be located closer to the tip of the short probe (middle left) and long probe (bottom left). The same smaller test pattern, when used with the VCOM system, still produced a dark image (top right), so the original test pattern was moved closer to the probe tip resulting in close-ups of the left edge (middle right) and top edge (bottom right) of the test pattern that were used to extrapolate the resolution similar to the JEDMED system. The captured images shown on Part 1 of 2 are Test Image #14 (top images), #15 (middle left), #51 (bottom left), #14c (middle right) and #14d (bottom right) previously described in the table entitled *TEST IMAGE LIST*. The captured images shown on Part 2 of 2 are Test Image #14 (top left), #14a (middle left), #14b (bottom left), #14a (top right), #14c (middle right) and #14d (bottom right) previously described in the table entitled *TEST IMAGE LIST*.

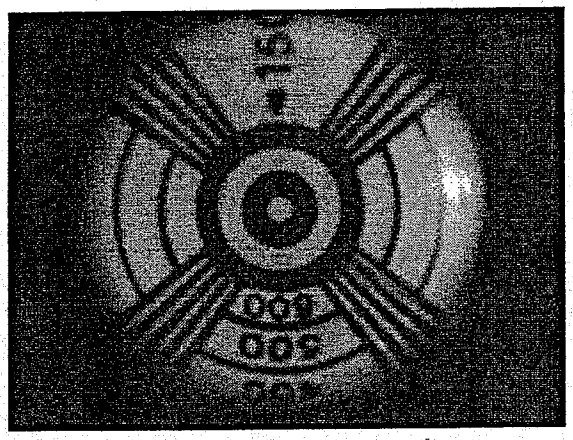
FIELD OF VIEW (PART 1 OF 2)



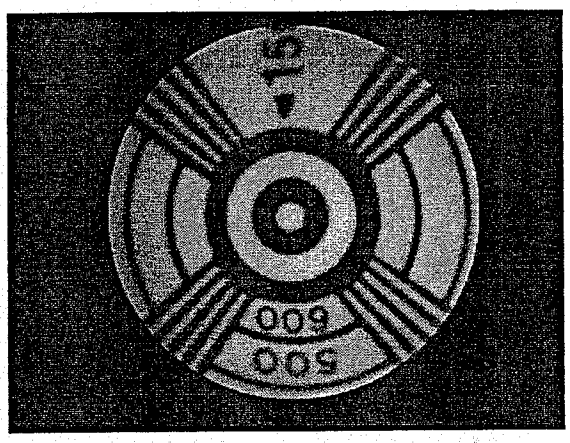
Welch Allyn (AMD)



JEDMED Instrument Co.



MedRx Inc. (Short probe)



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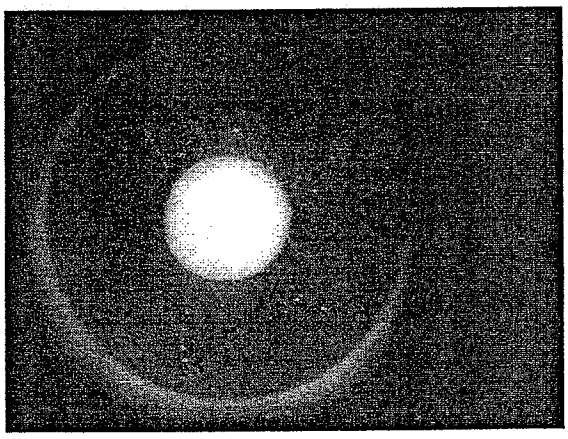
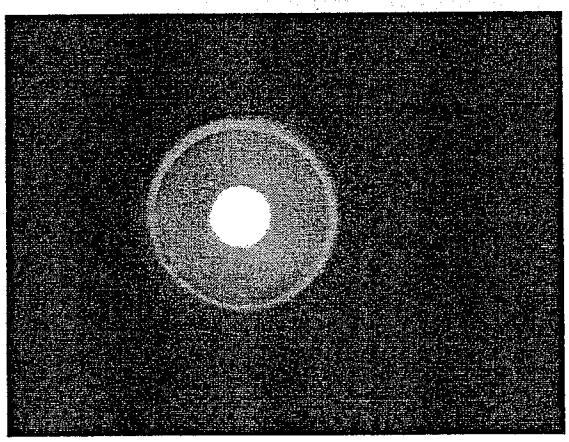
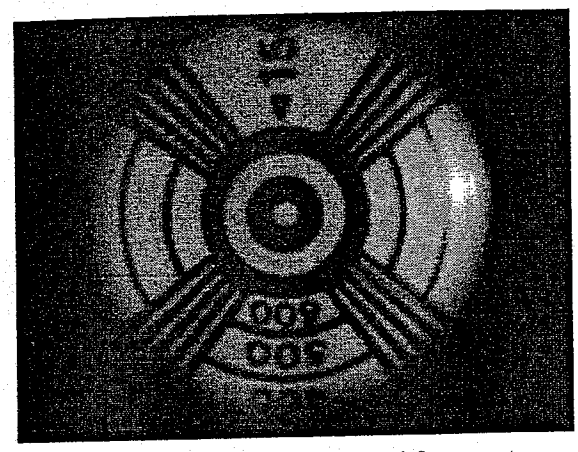


VCOM Systems

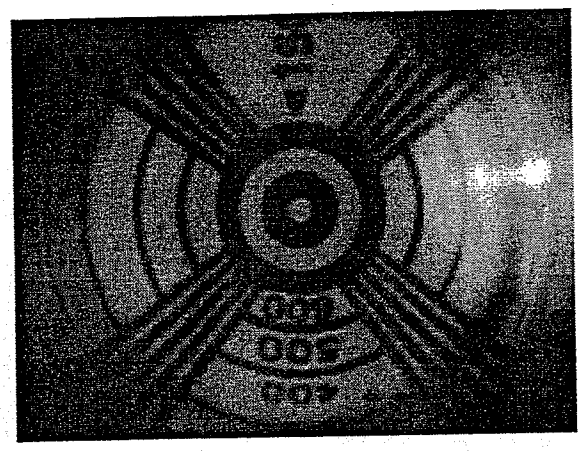


VCOM Systems (without 2x extender)

FIELD OF VIEW (PART 2 OF 2)



MedRx Inc. (Short probe with aperture, camera without aperture)



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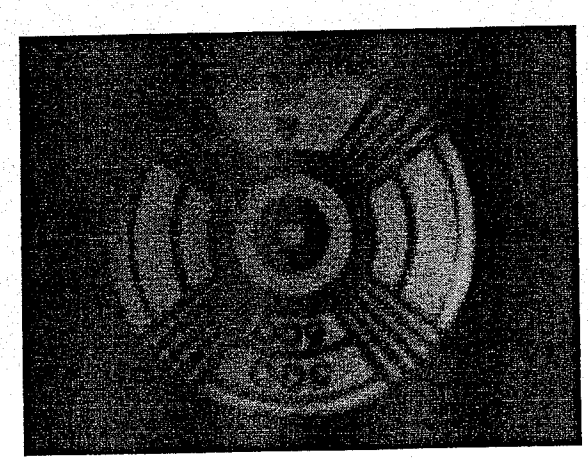

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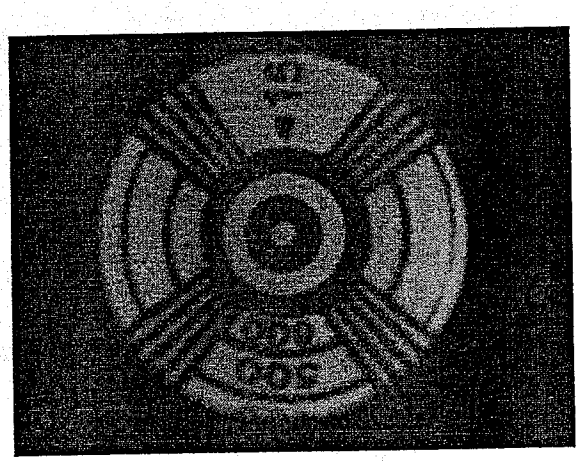

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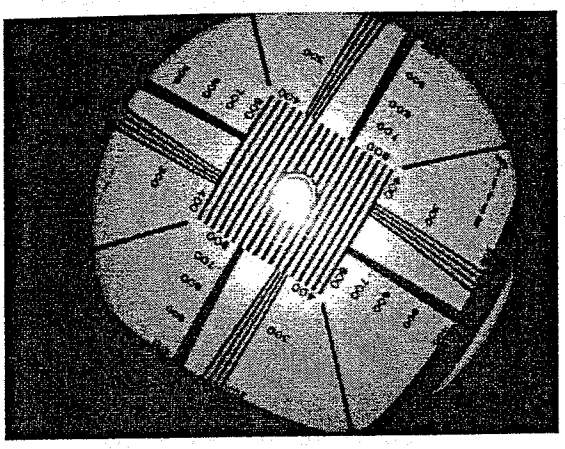
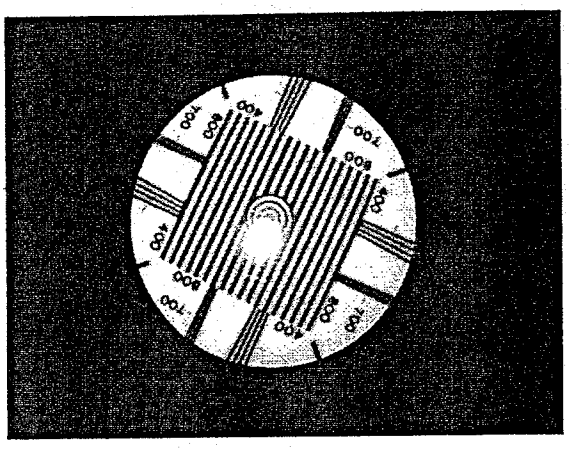
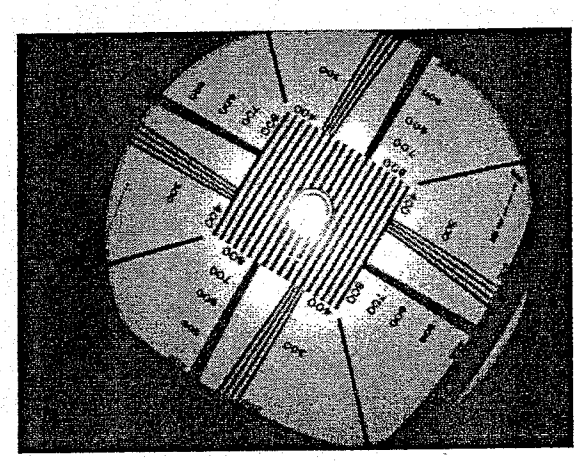
FOCUS AND ILLUMINATION (PART 1 OF 2)



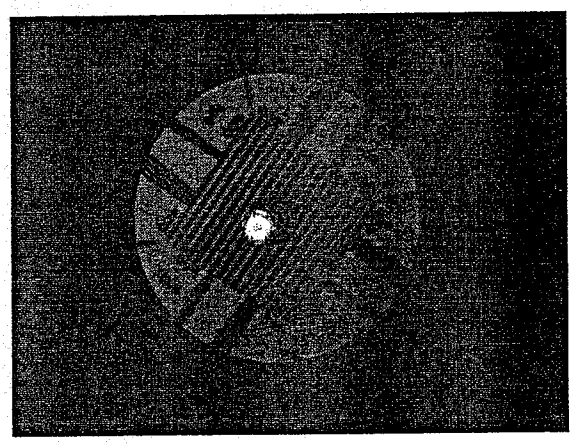
Welch Allyn (AMD) Full Light



JEDMED Full Light



Welch Allyn (AMD) ½ Light



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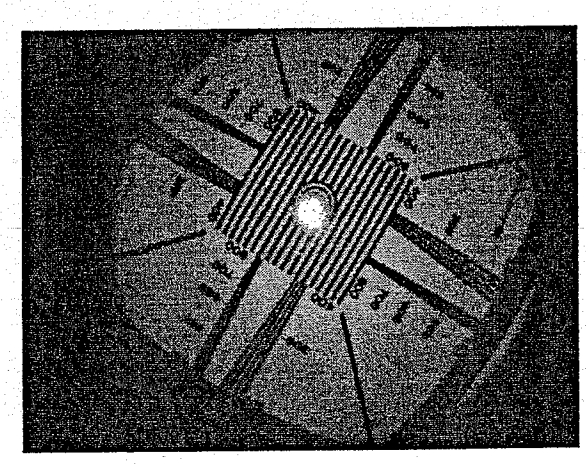

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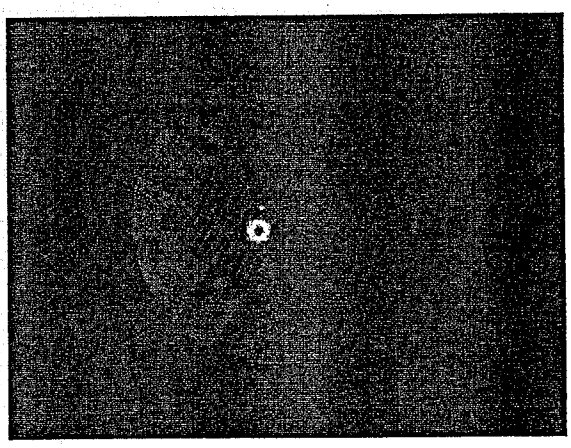

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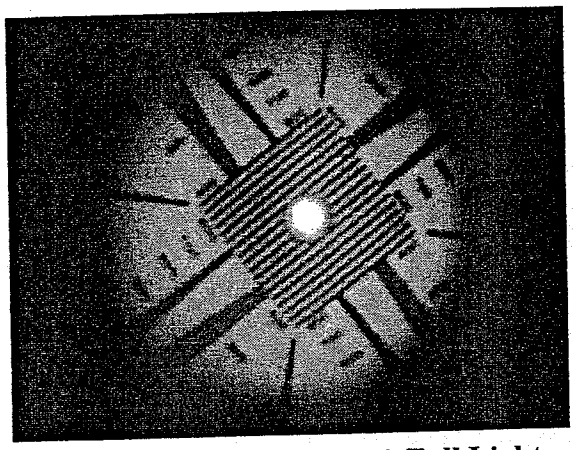
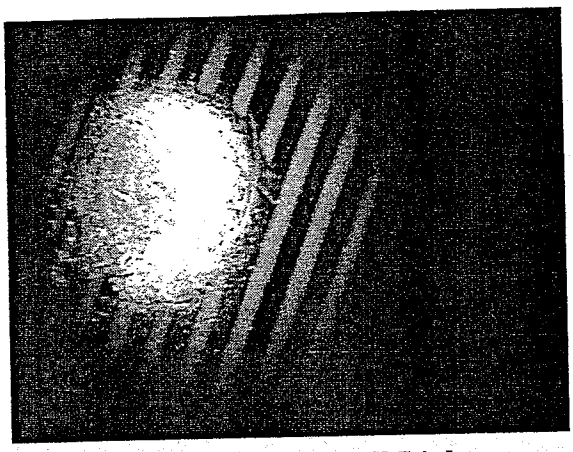
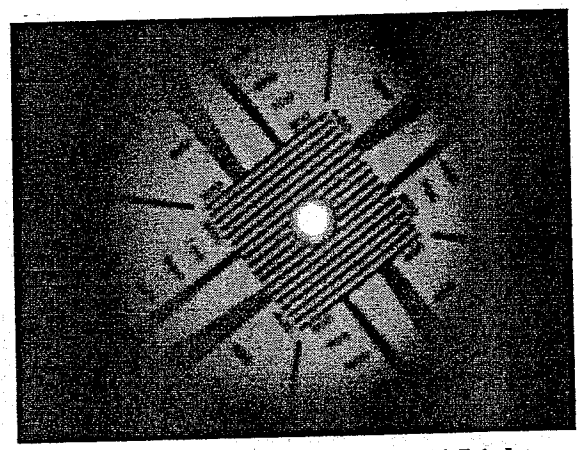
FOCUS AND ILLUMINATION (PART 2 OF 2)



MedRx Inc. (Short probe) Full Light



VCOM Systems Full Light



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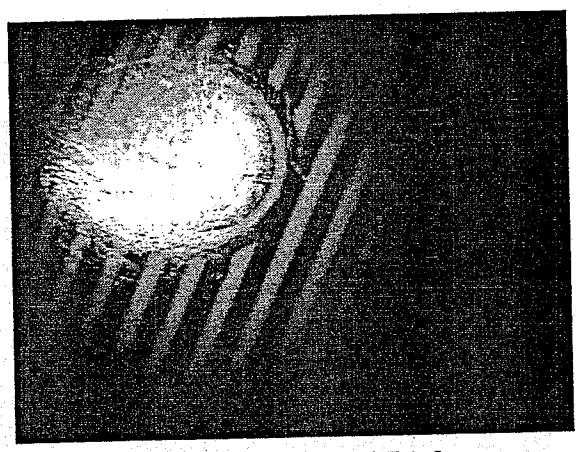

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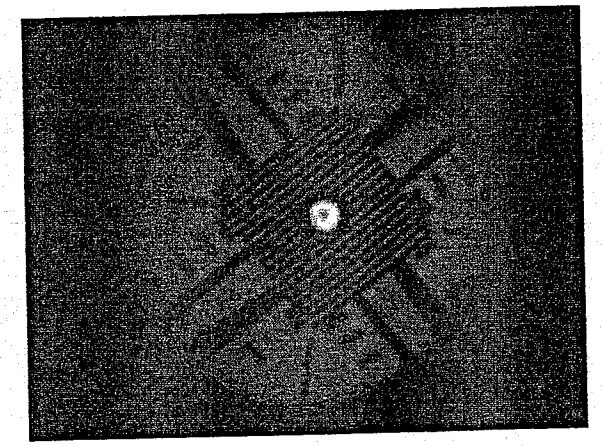

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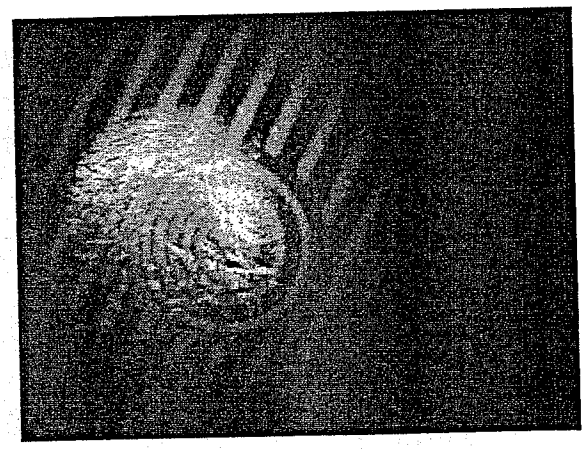
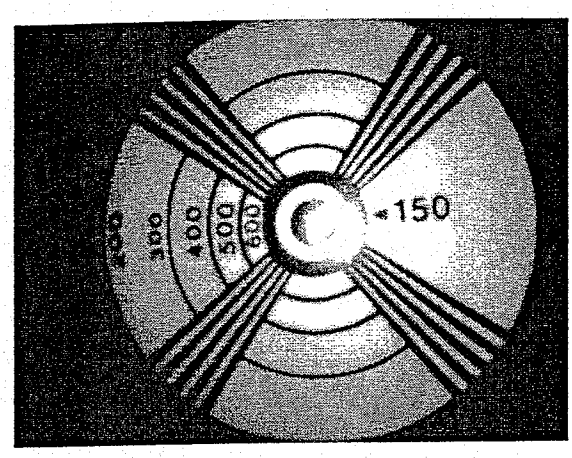
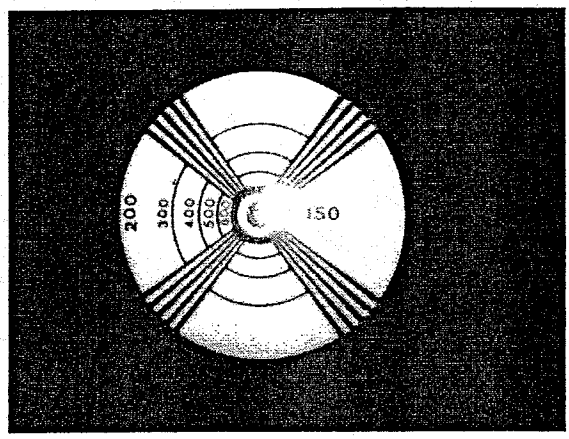


VCOM Systems ¼ Light

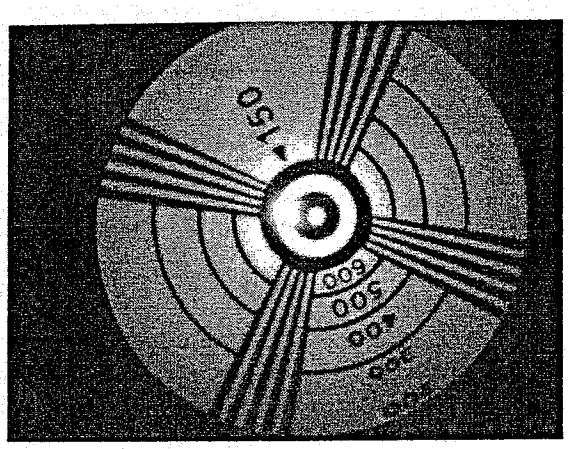
DEPTH OF FIELD (PART 1 OF 3)



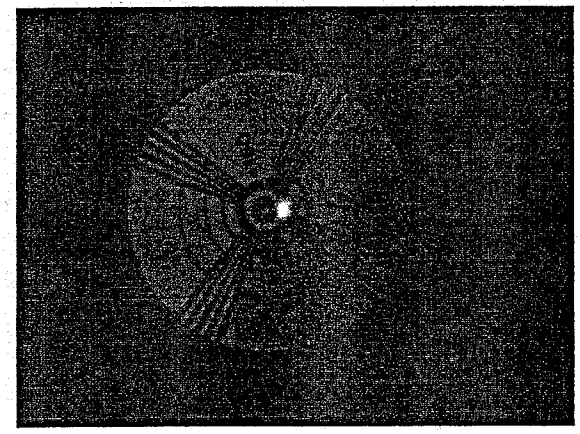
Welch Allyn (AMD) Initial Image



JEDMED Initial Image



Welch Allyn (AMD) Distant Image



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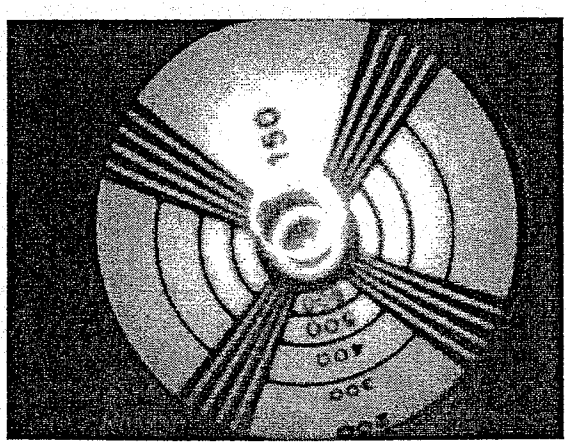
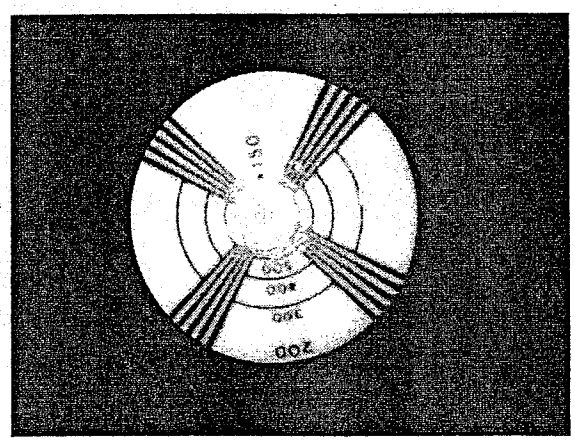
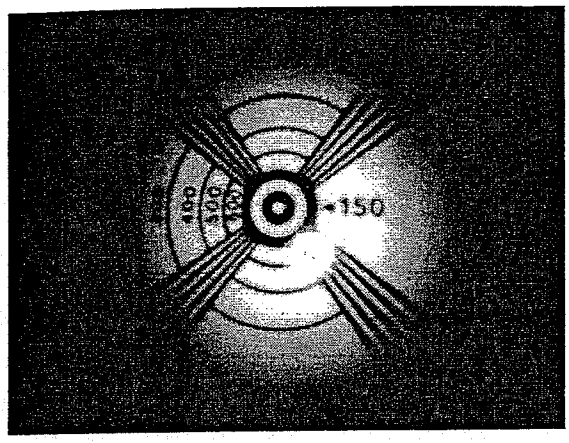


Welch Allyn (AMD) Closer Image

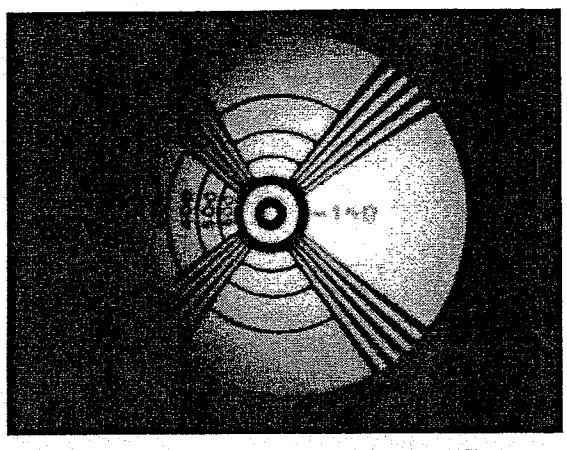


JEDMED Closer Image

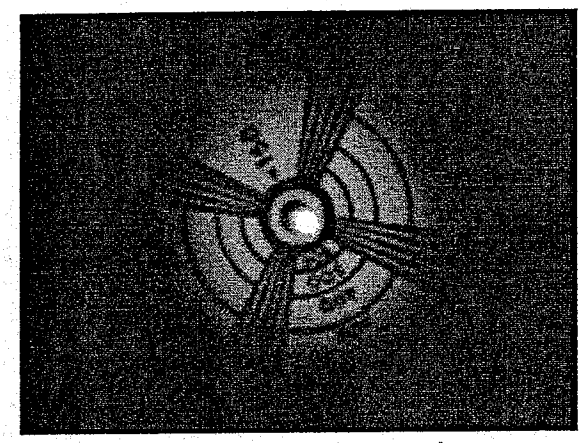
DEPTH OF FIELD (PART 2 OF 3)



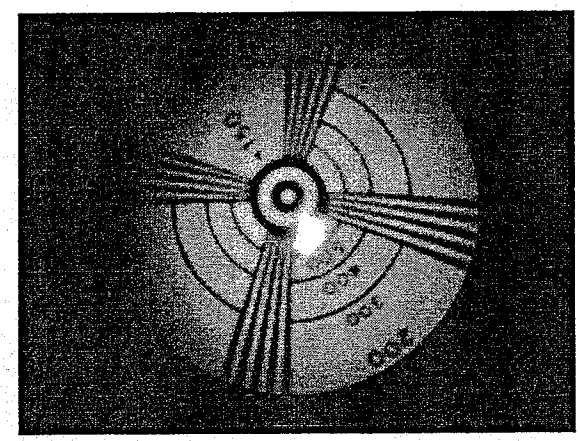
MedRx Inc. (Short probe) Initial Image



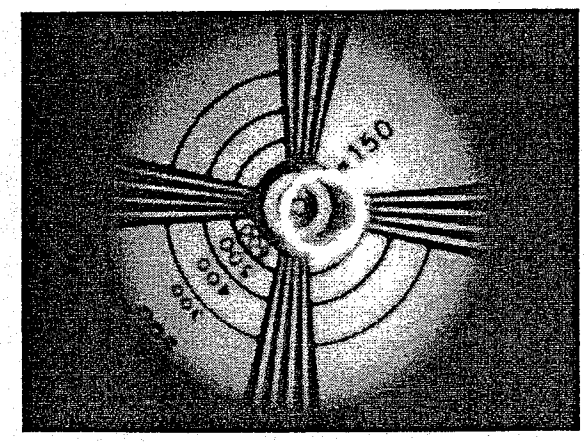
MedRx Inc. (Long probe) Initial Image



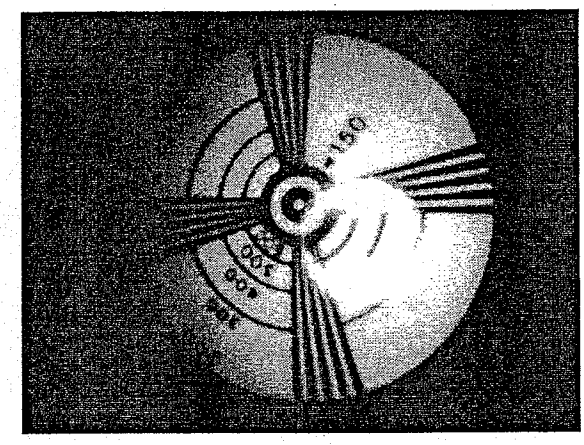
MedRx Inc. (Short probe) Distant Image



MedRx Inc. (Long probe) Distant Image

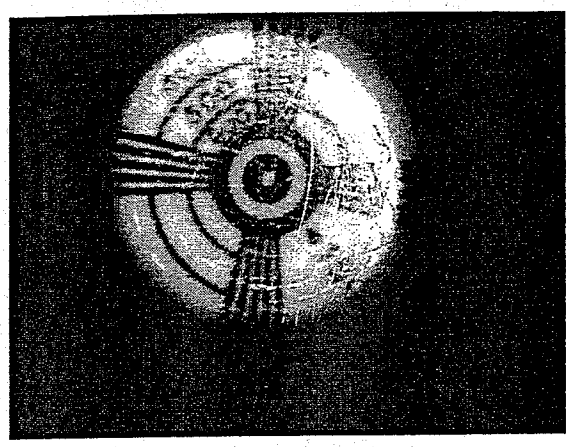


MedRx Inc. (Short probe) Closer Image

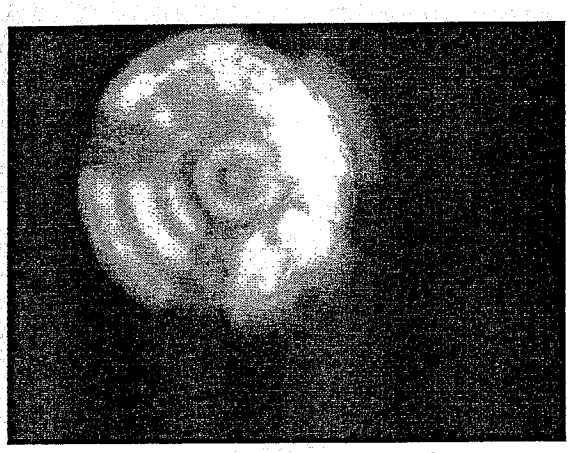


MedRx Inc. (Long probe) Closer Image

DEPTH OF FIELD (PART 3 OF 3)

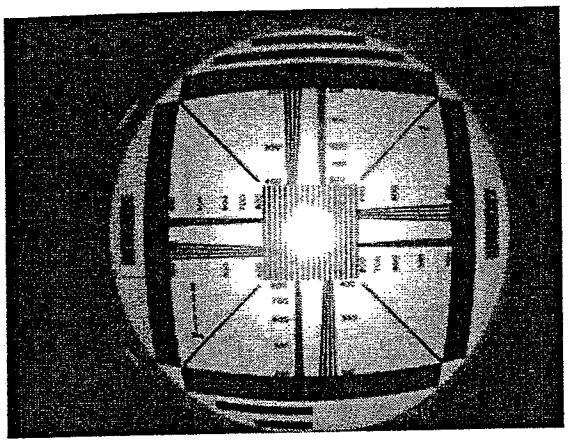


VCOM Systems Initial Image

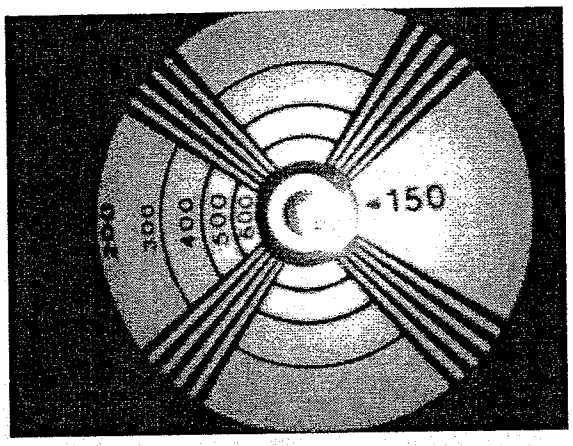


VCOM Systems Distant Image

DISTORTION (PART 1 OF 2)



Welch Allyn (AMD)



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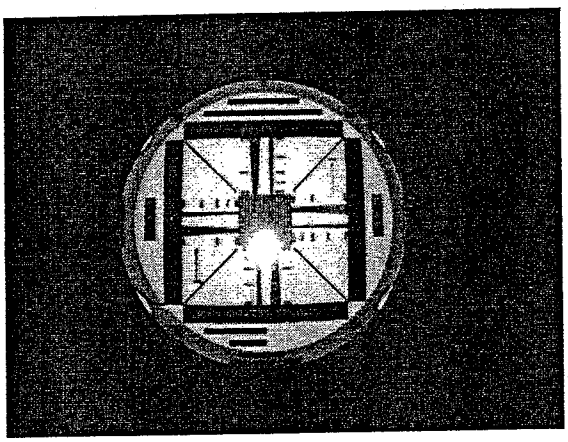
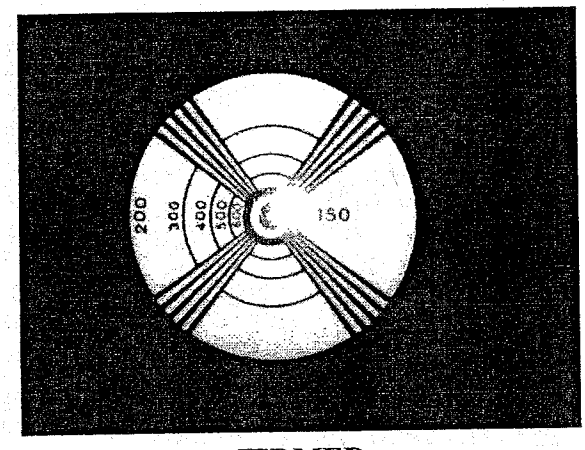


JEDMED



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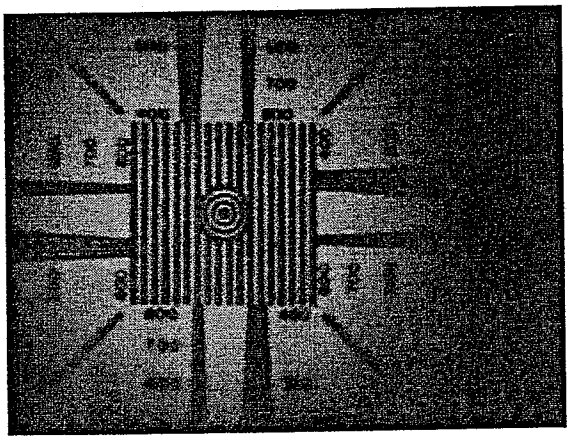
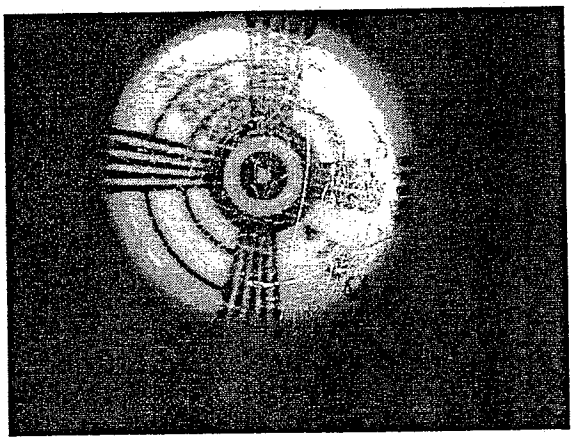
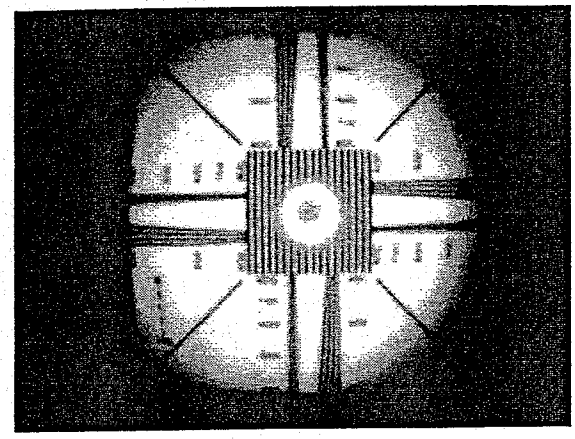


VCOM Systems

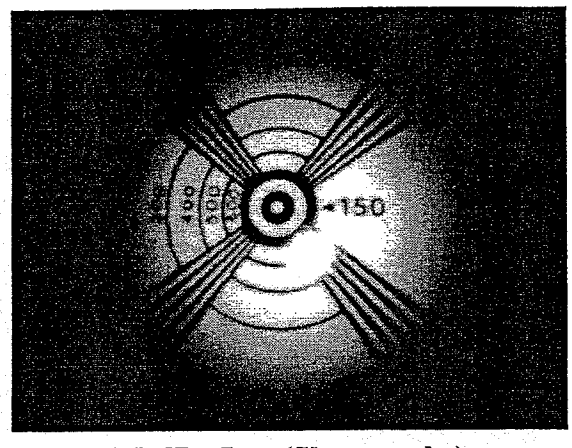


VCOM Systems

DISTORTION (PART 2 OF 2)



MedRx Inc. (Short probe)



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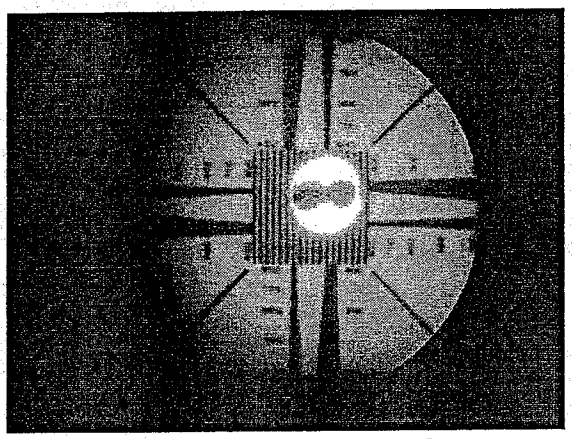

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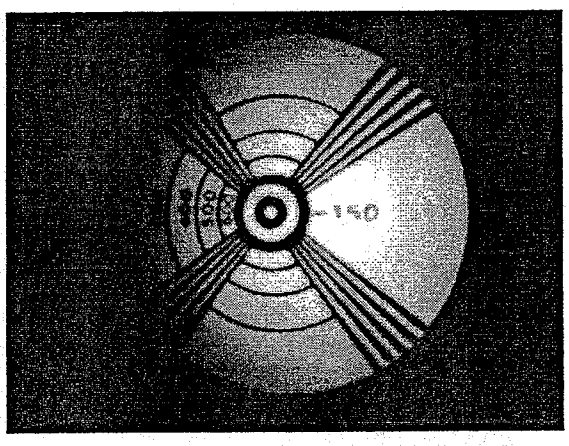
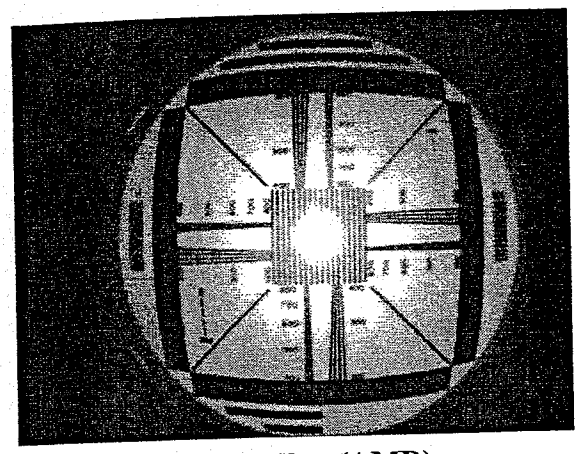
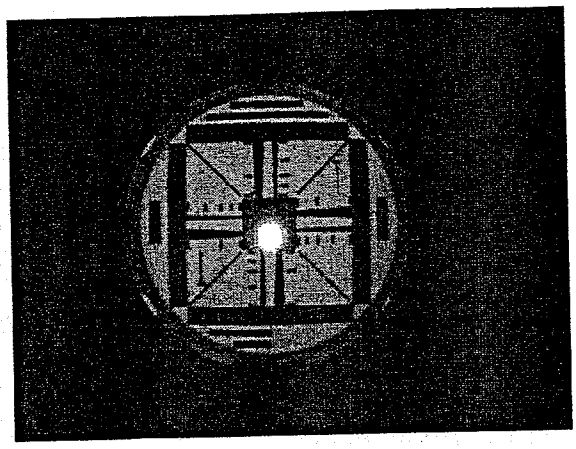


MedRx Inc. (Long probe)

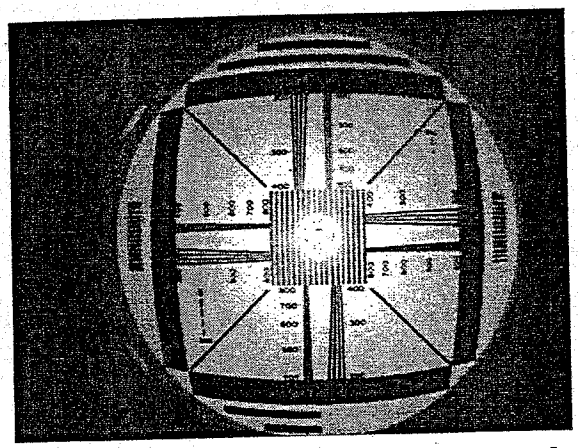
RESOLUTION OF SYSTEM (PART 1 OF 2)



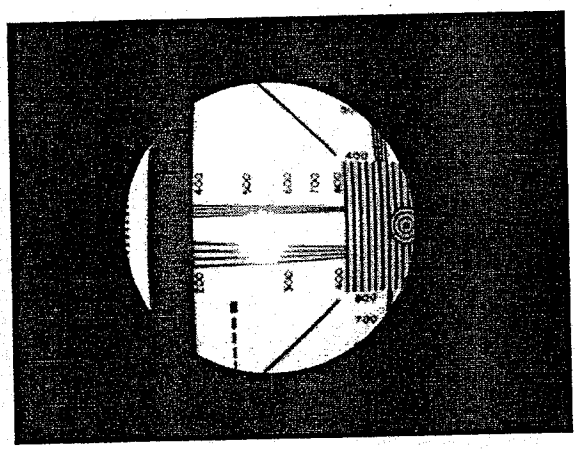
Welch Allyn (AMD)



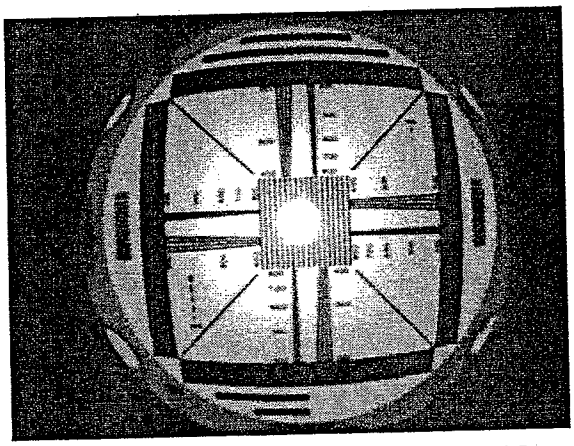
JEDMED



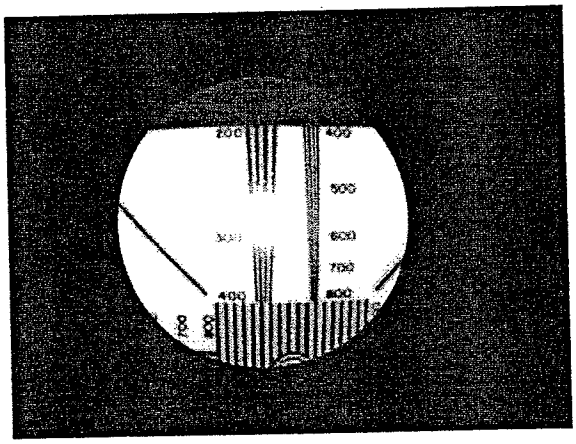
Welch Allyn (AMD) - Image Enhanced



JEDMED – Close-up of Left Edge

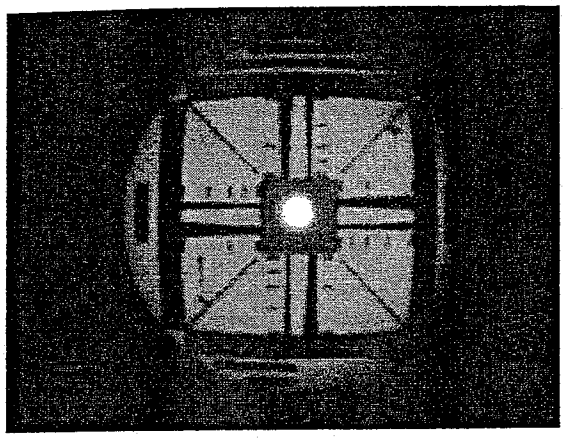


Welch Allyn (AMD) - Composite Video

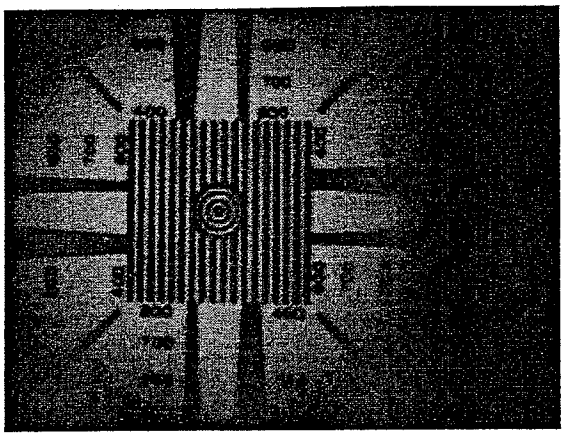


JEDMED – Close-up of Top Edge

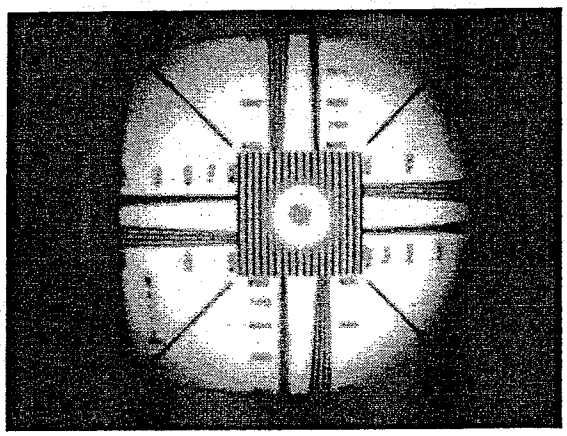
RESOLUTION OF SYSTEM (PART 2 OF 2)



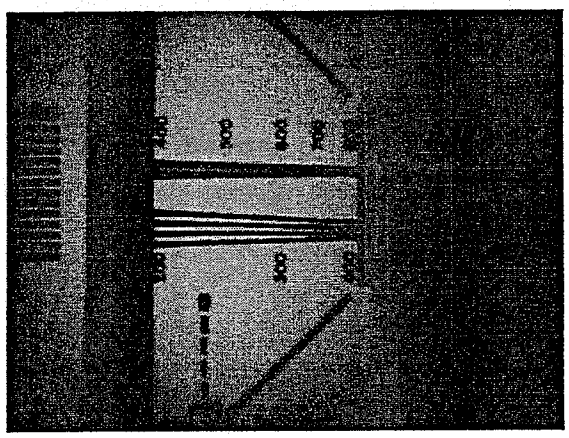
MedRx Inc. (Short probe)



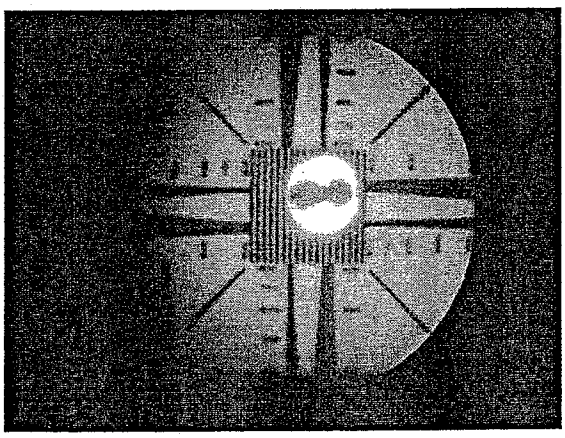
VCOM Systems - Closer



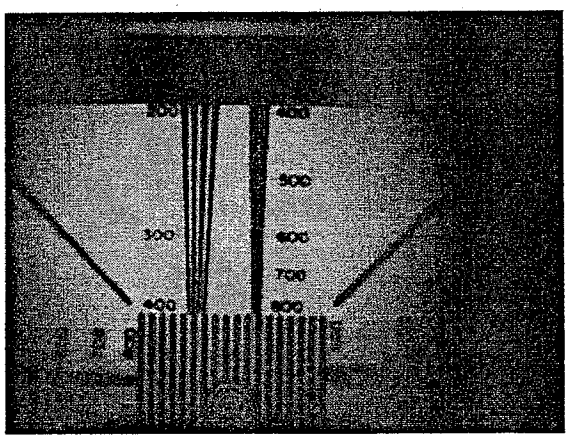
MedRx Inc. (Short probe) - Closer



VCOM Systems - Close-up of Left Edge



MedRx Inc. (Long probe) - Closer



VCOM Systems - Close-up of Top Edge

List of Tables

These tables are included on the following pages:

- *RESULTS: FIELD OF VIEW.* Table of results for the tested field of view of the otoscope probes. The manufacturer's specifications are also included for comparison. Also includes the actual percentage of the image output occupied by the otoscope image. The figure is shown as a raw percentage, and shown as a percentage of the theoretical best possible value (of 58.9%). (Note: missing data indicates the specification was not available, "*n/a*" indicates the data was *not available* because the specification or test does not apply to the manufacturer.)

- *RESULTS: DEPTH OF FIELD.* Table of results for the tests on depth of field. The manufacturer's specifications are also included for comparison. (Note: missing data indicates the specification was not available, "*n/a*" indicates the data was *not available* because the test could not be conducted.)

- *RESULTS: RESOLUTION OF SYSTEM.* Table of results for the tests on system resolution near center. (Note: missing data indicates the specification was not calculated, "*n/a*" indicates the data was *not available* because the test was not relevant or the data could not be determined from the images.)

- *RESULTS: DOT RESOLUTION OF SYSTEM.* Table of the product of "system resolution" (horizontal × vertical lines of resolution near center) and "percent area covered by otoscope image". These rough numbers (expressed as "K" or 1,000's) indicate the number of distinct dots on a pattern that could be discerned in an output image from the otoscope system. (Note: missing data indicates the specification was not calculated, "*n/a*" indicates the data was *not available* because the test was not relevant or the data could not be determined from the images.)

RESULTS: FIELD OF VIEW

Feature	Welch Allyn (AMD)	JEDMED	MedRx (Short Probe)	MedRx (Long Probe)	VCOM Systems
Calculations for Field of View for Probe					
Field of View distance (mm)	29.4	29.4	29.4	29.4	29.4
Field of View radius (mm)	23.0	12.0	23.0	16.0	3.5
Field of View radius with otoscope aparature (mm)	n/a	n/a	21*	n/a	n/a
Field of View radius with camera aparature (mm)	n/a	n/a	17*	n/a	n/a
Field of View radius with otoscope and camera aparature	n/a	n/a	17*	n/a	n/a
Field of View angle (deg.)	76*	44*	76*	57*	14*
Field of View angle with otoscope aparature (deg.)	n/a	n/a	71*	n/a	n/a
Field of View angle with camera aparature (deg.)	n/a	n/a	60*	n/a	n/a
Field of View angle with otoscope and camera aparature	n/a	n/a	59*	n/a	n/a
Manufacturer's Specifications					
Manufacturer's claimed field of view (deg.)	76*		60* (+10*/-5*)		
Percent Image Area Covered By Otoscope Image					
Without speculum	58.9%	27.7%	58.9%	46.0%	36.0%
With 2.5 mm speculum	58.9%	n/a	n/a	n/a	8.3%
With 3 mm speculum	58.9%	27.7%			12.9%
With 5 mm speculum	58.9%	n/a			35.0%
Without speculum, without 2x extender	n/a	n/a	n/a	n/a	12.2%
With 2.5 mm speculum, without 2x extender	n/a	n/a	n/a	n/a	2.8%
With 3 mm speculum, without 2x extender	n/a	n/a	n/a	n/a	3.7%
With 5 mm speculum, without 2x extender	n/a	n/a	n/a	n/a	7.8%
Percent Ideal Image Area Covered By Otoscope Image (Actual Coverage / Best Possible Coverage)					
Without speculum	100.0%	47.0%	100.0%	78.0%	61.0%
With 2.5 mm speculum	100.0%	n/a	n/a	n/a	14.1%
With 3 mm speculum	100.0%	47.0%	n/a	n/a	22.0%
With 5 mm speculum	100.0%	n/a	n/a	n/a	59.4%
Without speculum, without 2x extender	n/a	n/a	n/a	n/a	20.6%
With 2.5 mm speculum, without 2x extender	n/a	n/a	n/a	n/a	4.3%
With 3 mm speculum, without 2x extender	n/a	n/a	n/a	n/a	6.3%
With 5 mm speculum, without 2x extender	n/a	n/a	n/a	n/a	13.3%

RESULTS: DEPTH OF FIELD

Feature	Welch Allyn (AMD)	JEDMED	MedRx (Short Probe)	MedRx (Long Probe)	VCOM Systems
Testing Conditions - Initial Image					
Diameter of bullseye pattern (mm)	16.0	16.0	16.0	16.0	5.0
Estimated distance from pattern to probe (mm)	10.2	19.8	10.2	14.7	3.2
Testing Conditions - Distant Image					
Diameter of bullseye pattern (mm)	77.0	77.0	77.0	77.0	5.0
Estimated distance from pattern to probe (mm)	49.2	94.2	49.2	70.7	6.4
Testing Conditions - Closer Image					
Diameter of bullseye pattern (mm)	9.0	9.0	9.0	9.0	n/a
Estimated distance from pattern to probe (mm)	5.7	11.0	5.7	8.3	n/a
Depth of Field					
Farthest Focus	Infinity	Infinity	1/2"	<1"	2.7"
Typical range of focus without manual further manual intervention	Less than 1/4" to greater than 1"	Less than 1/4" to greater than 1.5". Very wide range of focus - makes is difficult to determine the exact best	Less than 1/4" to about 1/2"	1/4" to less than 1"	1/4" to 3/8" Extremely narrow range of focus - difficult to manually adjust.
Manufacturer's Specifications					
Manufacturer's claimed focal range			Focal plane is at .25" (+/- 125")		

RESULTS: RESOLUTION OF SYSTEM

Feature	Welch Allyn (AMD)	JEDMED	MedRx (Short Probe)	MedRx (Long Probe)	VCOM Systems
Resolution Near Center - Estimated From Test Patterns					
Uncertainty in measurements	+/- 10%	+/- 10%	+/- 10%	+/- 10%	+/- 10%
Horizontal lines of resolution near center (S-video)	430	476	n/a	n/a	370
Vertical lines of resolution near center (S-video)	309	273	n/a	n/a	195
Horizontal lines of resolution near center (Composite video)	337		347	319	
Vertical lines of resolution near center (Composite video)	322		243	245	
Horizontal lines of resolution near center (Image	485	n/a	n/a	n/a	n/a
Vertical lines of resolution near center (Image Enhancement)	309	n/a	n/a	n/a	n/a

RESULTS: DOT RESOLUTION OF SYSTEM

Feature	Welch Allyn (AMD)	JEDMED	MedRx (Short Probe)	MedRx (Long Probe)	VCOM Systems
Resolution Near Center - Estimated From Test Patterns					
Dot resolution near center (S-video)	78 K	36 K	n/a	n/a	26 K
Dot resolution near center (Composite video)	64 K		50 K	36 K	
Dot resolution near center (Image Enhancement)	88 K	n/a	n/a	n/a	n/a

Features

Introduction

All tested otoscope systems offered a wide variety of intrinsic features and limitations, ranging from the ability to conduct pneumatic otoscopy to the ability to use various sizes of specula on the probe tip. A review of features is presented in the following sections, and summarized in the table entitled *FEATURES.*

Probe Features

The otoscope probes supplied with each system varied in their ability to support different sizes of specula. Both the Welch Allyn probe and the VCOM system supported the standard Welch Allyn disposable specula in sizes 2.5 mm and 4 mm. We believe both the JEDMED and MedRx short probe only support a non-disposable 3 mm speculum, although we have been informed by other users that they managed to find 2.5 and 4 mm specula that work with the MedRx short probe. However, neither system supports the standard Welch Allyn disposable specula of any size. No specula may be used on the MedRx long probe. This probe is not intended to support specula or be used on the ear; it is designed for use on other body cavities such as the mouth.

The probes also differed in their ability to image body cavities other than the ear canal. Welch Allyn markets their probe as an "ENT" probe, and it is capable of being inserted into both nasal and oral cavities. The probe is long (extending 3.25" beyond the fiber optic cable coupler), and easily inserts into the mouth to focus on the rear of the mouth as well as teeth. The barrel on the probe may be removed, revealing a probe that is 2.75" long with a 3 mm diameter. This probe may be inserted into very narrow openings if required. The JEDMED probe has a similarly narrow but shorter probe which extends 1" for probing narrow openings. The MedRx short probe is thicker than either JEDMED or Welch Allyn, and has a narrow portion of the probe (with a diameter less than 6 mm) that extends less than an inch. The MedRx long probe is even thicker, but has a longer section that extends 2" with a diameter of less than 1/2". Since the VCOM systems uses a standard otoscope, it has no real "narrow" section but instead has a tapered section holding the speculum that extends 1" in front of a handle. This system is particularly ill suited for use on other body cavities.

All systems tested, except for the probes from MedRx, provided an option for pneumatic otoscopy. The MedRx long probe was the only probe tested which provided an irrigation tube.

Each manufacturer provided a specific means for aligning the probe with the camera to produce a "right side up" image, rather than an "upside down" image. Welch Allyn provided a white spot on the camera that indicated the "top" of the image. Holding the otoscope probe/camera unit with this spot pointing up always assured the image would be "right side up". JEDMED, by virtue of the cigar shaped unit containing the CCD and probe, always produced "right side up" images based on the cigar-shaped unit being held correctly (very easy to assure). The MedRx system used a Watek camera that had to be properly aligned with the probe to produce the correct image. The short probe required that the Watek camera be mounted "upside down" (literally the Watek labels and controls had to be upside down) on the probe to produce a "right side up" image. However, the long probe required the Watek camera be positioned "right side up" to get the image correctly. The VCOM system provided a mark on the camera that indicated "right side up" and made for easy alignment.

Illumination System

Different light bulbs and different methods for varying the light intensity distinguished the illumination systems provided by each manufacturer. The Welch Allyn system uses a 24 Watt "Solarc" light bulb to provide a 5500K white light, whereas JEDMED and MedRx use a 150 Watt halogen light bulb and VCOM Systems uses the inherent "flash-light type bulb" of the standard otoscope. The Solarc bulb costs approximately 8-10 times more than a halogen bulb, but this may be offset by its longer lifetime (Welch Allyn claim it last 700% longer). The Solarc bulb is, however, sensitive to cold and should not be energized until it has warmed above freezing temperatures.

Since the cameras in each system can be balanced to whatever light source is used, the equivalent temperature of light bulb would seem to be irrelevant. An important issue would be to maintain the white balance -- or light spectrum -- at all levels of intensity. The Welch Allyn illumination system provided the best technique for maintaining the white balance by using a variable aperture to control the light intensity rather than vary the intensity of the light bulb. Regardless of the intensity, this system produced a constant white illumination at 5500K. Other systems, such as the MedRx system, varied the intensity of the illumination by varying the power supplied to the Halogen bulb. This produced significantly more red light at low intensity, which generated a shift to more red colors in the output image. Consequently, these systems provide poorer color accuracy at lower illumination levels.

While we generally preferred the "true white" light projected by the Welch Allyn equipment, it should be noted that balancing to this white light causes images illuminated by typical room lights (e.g. halogen, fluorescent, incandescent bulbs) to appear yellow or red, until the systems is re-balanced to the room light (see earlier section on Color Accuracy). This may cause problems, for example, when a health care provider attempts to use the Welch Allyn system to capture a dermatology picture by replacing the ENT probe with a standard lens -- but forgets to properly white balance the system. This may also cause a problem even when the provider does balance the system -- but forgets to re-balance the system once the ENT probe is re-attached. This is not a problem when using the MedRx system, because the camera is color balanced to the halogen light source and works effectively with normal room lighting without further adjustment.

Output

All tested systems, except for the MedRx system, provided both composite and S-video outputs. All tests indicated that the image quality improved using S-video output, particularly for horizontal resolution. Whenever possible, S-video output should be used to achieve the highest quality images.

It should be noted that the observed differences between S-video and composite video output might result from the frame grabber card, and not be intrinsic to the video otoscope systems. For example, a frame grabber card that samples the composite video input line at half the rate of the S-video input line would normally produce images of lower resolution on the composite versus S-video images. We have not been able to test the intrinsic resolution limits on the FlashPoint frame grabber used for these tests to determine if the frame grabber is responsible for skewing the results. The point may be moot since we are testing the resolution of a "system" which includes not only the otoscope probe but also the FlashPoint frame grabber (or an equivalent card) that will be used in the workstation for the Alaska Telemedicine Testbed Project. Otoscope systems supplying an S-video output coupled with the FlashPoint frame grabber provided the "sharpest" images with the highest resolution.

Other Uses

All systems were reviewed for use in video otoscopy, but some systems provide the capability to be used with other clinical specialties using either the otoscope probe or a different probe or lens. The Welch Allyn system provides a coupler that connects the camera to the ENT probe, and a similar coupler may be obtained as an option for the MedRx system. This coupler allows the MedRx camera and the Welch Allyn camera to attach to "standard" eyepieces of other equipment, such as opthalmoscopes and slit lamps. However, in a review of the equipment located at the Anchorage Native Medical Center, we were only able to locate 1 in 8 slit lamps to which the coupler would attach. A review by optometrist (see later section) using the coupler with an opthalmoscope indicated this was not a viable option, because the coupler does not allow the user to simultaneously view the image through the eyepiece. We did not attempt to use the coupler to attach to other probes, although that is a distinct possibility since Welch Allyn (and MedRx to a lesser extent) offer a variety of probes. Welch Allyn also offer a dermscope that may be used for contact dermatology. Both systems also allow a standard C or CS-mount lens to be fitted onto the camera, which allows the system to be used for a wide range of purposes -- from non-contact dermatology studies to video conferencing.

The JEDMED system does not provide a coupler to attach to other eyepieces and cannot be fitted to a standard lens for other purposes, but JEDMED does offer a range of probes that may all be coupled to their camera and light source.

The VCOM system can be coupled to other eyepieces, similar to the coupler on the Welch Allyn and MedRx units, but offers the additional advantage of maintaining the viewport for the user while employing a beam splitter to send the image to the camera. This device was tested on an opthalmoscope and found to be better than the Welch Allyn since the user could simultaneously see the image. However, the narrow angle of view associated with this system made it difficult to obtain good retinal images (see later section).

FDA Approval

It is clear that the video otoscopy system must meet FDA standards for the diagnostic purposes for which it is intended. We have not been able to determine from the FDA exactly what these standards are. We are aware of the following:

- MedRx claims that "MedRx complies with the FDA 510(k) classification for video otoscope systems." This does not say anything about being FDA approved. In a letter from the FDA to MedRx on 4/26/94), the FDA states that the FDA has "determined the device is substantially equivalent to devices marketed ... but it does not mean that the FDA approves your device".

- We do not have any statements from the FDA for Welch Allyn equipment, but a technical offer from AMD regarding the video otoscopy system claims "It carries full FDA review and approval for use as a medical device to capture images of the ear, nose and throat in human subjects for consultation and diagnostic purposes."

We do not know the status of FDA approval on JEDMED or VCOM Systems equipment.

List of Tables

This tables is included on the following pages:

- *FEATURES.* Table of features associated with each tested system.

FEATURES
Part 1 of 2

Feature	Welch Allyn (AMD)	JEDMED	MedRx (Short Probe)	MedRx (Long Probe)	VCOM Systems
Probe Features					
Smallest speculum	2.5 mm disposable.	3 mm non-disposable.	3 mm non-disposable.	None fit	2.5 mm, but significantly smaller image on screen (occluded by speculum).
Largest speculum	4 mm ?	3 mm non-disposable.	4 and 5 mm non-disposable.	None fit	5 mm
Length of otoscope beyond couplers (distance to push into mouth for example)	3.25", with 2.75" belonging to the probe with 2.5 mm dia.	Entire probe is cigar shaped with all cables coming out back. Probe extends in front by 1.375", with 1" belonging to the probe with 2.7mm dia.	1.4", with 0.85" belonging to probe with <1/4" diameter.	2.75", with 2.0" belonging to probe with <1/2" diameter.	1 1/8"
Option for Pneumatic otoscopy	Yes	Yes	No	No	Yes
Other		Beautiful shaping for handling. Cable is stiff, making it awkward to rotate as needed during an ear	The otoscope probe reverses the image such that the camera is effectively held upside down.	Does not reverse the image, so the camera must be held right-side up.	
Illumination System					
Type	Welch Allyn Solarc 24 Watt lamp. Maintains full spectrum throughout life. Supplied with 2 bulbs (one spare). Lamp guaranteed not to fail during an exam.	Halogen 150 Watt	Halogen 150 Watt	See Short Probe	Flashlight-type tungsten bulb.
Temperature	5500 K	3400 K	3400 K	See Short Probe	
Cost	$300	$20 ?	$20 ?	See Short Probe	
Expected Lifetime	350-500 hours based on 60 minute on/15 minute off duty cycle. AMD claims it last 700% longer than halogen lamps.	250 hours?	250 hours	See Short Probe	
Output(s)					
Y/C S-Video Outputs	2	1	0	See Short Probe	1
Composite BNC Video Outputs	2	1	1	See Short Probe	1

FEATURES
Part 2 of 2

Feature	Welch Allyn (AMD)	JEDMED	MedRx (Short Probe)	MedRx (Long Probe)	VCOM Systems
Other uses					
Lens mount	C mount	Proprietary	CS mount	See Short Probe	C or CS mount
Coupler	45 mm coupler	Proprietary	Optional 45 mm coupler	See Short Probe	Coupler
Attaching to other scopes	Adapter can be coupled to any other existing scope devices (e.g. opthalmoscope)	Capable of interchanging otoscope lens with some other JEDMED scopes.	Adapter can be coupled to any other existing scope devices (e.g. opthalmoscope) not tested.	See Short Probe	Beam splitter useful for connecting to any standard scope, while maintaining eyepiece for viewing.
Expandability	Attached to other scopes using adapter. AMD sells a wide variety of FDA approved scopes which work with this equipment (light source and camera) including dermscopes.	Manufacturer makes other scopes - no general camera lens will fit.	Attached to other scopes using adapter (untested). Supply some other scopes.		
Manufacturer					
Support	800 number, 24 hour support.		800 number, 8 hour/5 day support for first year.		
Warranty	1 year free on parts and labor (7% per year thereafter), includes return to factory with 10 day turnaround. Option for better warranty program with 36 hour shipment of spare unit and spare bulb program (added 8% first year, 15% each additional year).		1 year free on parts and labor, includes FedEx overnight delivery of replacement parts. Extended warranty (additional years) available at ahbout 9-10% of cost.		

Clinical Reviews

Introduction

During the course of the "bench" tests on the electronics and optics, a variety of clinicians were invited to provide comments on each otoscope system. Each system was connected to the same monitor for the tests, and each clinician, or group of clinicians, was asked to provide statements regarding such factors as ergonomics, clinical applicability, and image quality. Due to the availability of equipment, not all clinicians reviewed every tested system. A wide range of clinicians were invited to participate, and ranged from Session I Health Aides (introductory level of care provider in Alaska) to P.A.s (Physician Assistants) to M.D.s -- including the Chief of ENT at Alaska Native Medical Center.

Community Health Aide / Practitioner

A variety of Community Health Aides/Practitioners (CHAPs) were involved in reviewing equipment during training sessions at the Alaska Native Medical Center. These health aides were representative of the health care providers that will eventually be involved in capturing images at 25 villages as part of this project. A few health aides were actually from villages directly involved in this project, but most were from villages not involved in the project.

The health aides were asked to provide feedback concerning the viability of using video otoscopy in their clinics -- both to improve the quality of the health care they delivered and to promote patient health education. In all cases, health aides were able to test the Welch Allyn equipment, and occasionally the VCOM equipment. The availability of both the MedRx and JEDMED systems did not coincide with the training sessions, and were not reviewed by the health aides.

Welch Allyn (AMD)

- Felt Welch Allyn equipment was "back heavy" when trying to stabilize on a patient's head.
- Clearly felt a need to develop a CHA-specific method for using this equipment, that may be different from the "standard" method.
- Want a right-angle bend on the fiber optic cable to prevent the cable hitting the patient's shoulder.
- Attempted to view images of the nose using a speculum. Had no problems doing this, and felt it would be a very good use of the equipment.

VCOM Systems

- Not impressed with the equipment - felt it showed too small an area of the tympanic membrane.

Comments

- Earwax is not expected to be a major issue, and should not prevent good images being taken. Many higher-level health aides (CHPs) felt that everyone in the clinics, including the least experienced practitioners (Session 1 Health Aides), will have no problem removing earwax.

- Health aides wondered why we were doing ear disease, and would have preferred to study dermatology since they have trouble describing skin conditions to doctors over the phone.
- Interested in trying the cerumen management tip.
- Definitely see the advantage in having two monitors to view output - one for patient and one for provider.
- Initially skeptical about using equipment, but became excited and enjoyed seeing ear images on screen. Generally seemed enthusiastic about using the equipment, and see value in using equipment for patients to understand the problem and for educational purposes.

P.A. (Physician Assistant)

P.A.s were asked to review all the tested systems, and provided comments when using the equipment directly on a variety of patients including a 3 month old infant, a 20 month old toddler, a 4 year old, and several adults. All P.A.s had extensive experience providing care in rural Alaska (several with over 20 years experience) at village clinics, and all had extensive experience training other providers (CHAPs for example). One or more P.A. raised the following comments during the testing process.

Welch Allyn (AMD)

- Can see finer details of eardrum.
- Very good lighting, showing curvature of eardrum and even illumination of surrounding area.
- Very accurate colors.
- Very sharp image - very high diagnostic quality.
- The 2.5 mm speculum fits all children's' ears.
- Prefer the handling of this device.

MedRx Inc.

- Camera gets hot, and probe seems to develop hot spots.
- It seems to be a two-person job to use this device due to poor light response. Someone almost needs to be able to adjust the light level since the camera does not respond well to varying light intensity. Need a second person to handle the light adjustment.
- No markings for what side is up in order to get the correct image. As the device gets used, the otoscope barrel rotates so that the "right side up" slips and needs to be reset periodically.
- If the light strength is set at half (rather than full strength), the image is deceiving and looks out of color and even suggests a fluid build-up behind the eardrum.
- Can see full image of eardrum - but somewhat blurry picture and not too sharp.
- Poor color accuracy - washed out colors.
- Using 3 mm specula, could not get the otoscope into the ear of 3 month old.

JEDMED

- Poor color accuracy. Had trouble getting the system to attain an adequate reset for the white balance. Could not reset the color, then attain an image in a fist (in the hand) which showed pink skin. In the ear, the colors were very washed out. Turning the white balance to "Manual" generated pink colors in the ear - too red. Turning down the light intensity generated more realistic colors, but the output of the light source also was red.

- Image appears grainy.

- The image is very small on the display - does not take full advantage of the full 640x480 display.

- Ergonomically very nice to handle. Easily stabilized against the patient's head.

- Cable is very stuff - difficult to rotate within the ear. Cable is not too stiff for flexibility - just stiff for rotation.

VCOM Systems

- Only shows about a quarter of the area of the other systems - not enough for general diagnostic purposes.

- Very good color accuracy and details.

- Very difficult to focus - almost a two person job. Focus is picky, due to poor depth of field. Have to get focus just right to prevent blurring in picture.

Comments

- All devices are awkward to handle and use at first. Not used to having to use a monitor to view the image rather than see it through the otoscope.

- Worried about using on young children, especially 6 month olds. Possibly 60 -70% of patients will be in the age range of 6-36 months old -- all devices will be difficult to use on these patients especially by health aides. All devices were difficult to stabilize on the children's' ears. Choking down on the AMD equipment seemed to help but this may move the hand beyond the trigger (if we go to an "onboard" trigger). Suggest using a different design for handle and camera.

- The VCOM equipment is not useful for telemedicine purposes because it does not show the entire eardrum in a single picture - too small an angle of view. Both Welch Allyn and MedRx provide a full view of the eardrum, which is required for proper diagnostic purposes.

- The Welch Allyn equipment provides a superior view of the finer details of the eardrum, compared to MedRx. In a normal ear, it was possible with the Welch Allyn to completely describe the ear as normal due to the finer details seen of the curvature of the eardrum, sharper view of blood vessels, the incus, and the color of the eardrum. With the MedRx, it was not possible to see the curvature, the color was poor, the image was not as sharp, and the details behind the eardrum were not apparent. The MedRx unit would not be used to classify the normal ear as unhealthy, but neither could it be used to clearly state the eardrum was healthy. VCOM provides an image similar in details to the Welch Allyn equipment, but shows such a narrow area of the eardrum that it cannot be used to claim the eardrum in healthy from a single image.

- Overall, the combination of camera and light source provided by MedRx does not get as good a diagnostic image as that provided by the light source and camera from Welch Allyn.

- In terms of color accuracy, Welch Allyn is best, VCOM is second, and MedRx is third.
- In terms of the diagnostic quality of the image, Welch Allyn is best, MedRx is second, and VCOM is third due to the limit field of view.
- AMD was the preferred device for ease of use and handling, especially on children.
- Expect the CHA/Ps to get used to the equipment eventually.
- Positioning of the monitor is very important in the final design.
- Trigger is awkward - foot pedal was not used in this trial but even that may be too awkward to manage.
- Smaller specula are important - 2.5 mm especially.
- It would help to have the fiber optic light cable come off at a different angle, because it tended to hit the children's' shoulders when doing the exam.
- Trouble taking some images in young ears due to earwax.

ENT Specialist and Pediatrician

Both pediatricians and ENT specialists were invited to participate in reviewing all tested systems. Participants included the Chief of Otolaryngology, Head and Neck Surgery at the Alaska Native Medical Center (ANMC), the Chief of Epidemiology at CDC in Anchorage, AK (also a pediatrician at ANMC), and an ENT specialist at Geneva Woods Ear Nose and Throat Associate in Anchorage, AK. Equipment was evaluated on a 3 month old infant and several adults. One or more participants raised the following comments during the testing process.

Welch Allyn (AMD)

- Can we get the reusable SOFTIP speculum? The 2.5 mm has a sharpness to its edges that is not good and tends to gather wax and fluid onto the scope surface.
- Can we get a shorter probe - may be able to stabilize it easier on the head of children.
- If we use a 45 or 90 degree adapter for the fiber cable, we may actually be worse off because we loose the ability to grip the fiber optic cable to hold the unit.
- Second best ergonomics.
- Seems the AMD generates some wash out due to bright lighting.
- Would prefer to have a handle coming down with the fiber cable.
- Good that it has insuflation.

MedRx Inc.

- Recognizes problems with switches on back of MedRx unit and feels the manufacturer should hardwire these into a fixed position.
- Most ergonomic to use.

- Speculum too large for 3 month old. Speculum also caused "severe pain" in pediatrician doing own ear. Can we get smaller speculum for children?

- Image is pretty good.

- Easiest to stabilize on child.

JEDMED

- Washed out pictures under bright light. Need to turn down the light to get any picture - even with AGC on and all controls as specified for all image tests.

- This unit was the worst ergonomically. Difficult to judge the up or down position - rotates in the hand too easily without any obvious landmark.

- Cable is too stiff - difficult to handle.

- Poor image quality - narrow angle of view, small portion of image is actually the display, and grainy.

VCOM Systems

- VCOM is "hopeless" for capturing images, awkward to manipulate, focus, etc.

Comments

- Some felt the MedRx unit was more ergonomic than the Welch Allyn equipment -- lighter, easier to hold and manipulate. The AMD equipment felt longer and heavier and therefore less ergonomic. Others felt that both Welch Allyn and MedRx devices were not particularly difficult to use -- no huge preference for the handling of one over the other.

- Overall, prefers colors and sharpness in Welch Allyn, but feels the image output from either Welch Allyn or MedRx is sufficient for diagnostic purposes. Both provide adequate diagnostic-quality images. In a normal ear, get similar information from both devices.

- Welch Allyn provides better images for children - able to get the full tympanic membrane in view with the 2.5 mm specula, whereas the MedRx unit did not see the entire tympanic membrane (using 4 mm speculum) due to bends in the canal.

- Would prefer any manufacturer to "streamline" the design by adding a 90° bend in the fiber cable at the point it attaches to the otoscope, thereby causing the light cable to lie along the axis of the otoscope rather than dangle down from the probe.

- Color not as important in his clinical diagnosis with ear images.

- Landmarks are more important - need to capture images showing good landmarks. It will be very important to set standards for image capture - e.g. always attempt to have the anterior portion at the top of the image if possible. If this is not possible, can we flip the images in the viewer software to create the desired viewpoint?

- Pneumatic otoscopy important tool if looking for fluid, but may be too awkward to do that with the video otoscope. Perhaps best to conduct such tests using the normal otoscope. However, at least one physician felt insuflation is an important diagnostic tool

- Prefer to start with largest speculum, since this is best size for pneumatic otoscopy (gets best seal) and worry about small speculum going in too far. 90% of the time, the 4 mm speculum works on patients. Only need smaller speculum (2.5 mm) for Down's Syndrome children or

children with very small canals or lots of wax to get past. Also, normally get more light out of a regular otoscope with the large speculum - not the case for video otoscopy.

- Believe this will be a great training and educational tool.
- Hurt (severe pain) to take image with MedRx just to get close to the view offered by the AMD equipment.
- Tympanograms would be very useful. Best tympanometers are automated. Printouts are lousy - usually just dotted patterns that do not fax or scan well. Prefer serial connector with graphical data image. Health Aides are not currently trained on tympanograms.
- Audiograms are routinely done before tubes are put in, and usually try to do it again sometime during the 6 months post-surgery (or during the audiologist's visit within one year). Not absolutely necessary for follow-up procedure, and not very excited about having this done as part of telemedicine.

Other

The usefulness of a video otoscope is not strictly limited to ear examinations. We anticipate uses will be found in other clinical specialties, notably dermatology and optometry. Two system tested, Welch Allyn and VCOM Systems, seemed to offer the capability of being used with an opthalmoscope to capture retinal images. A group of regional-based optometrists (from Kotzebue, Nome, Sitka, Bethel and Anchorage) was asked to provide comments on these two systems. The VCOM System was mounted and tested on the opthalmoscope provided by the manufacturer. The Welch Allyn equipment was also tested on this same opthalmoscope. It should be noted that Welch Allyn does not market their product for this purpose (unlike VCOM Systems) -- and was only tested because it fit the equipment and provided an image.

Welch Allyn (AMD)

- More difficult to use than VCOM Systems since it does not have any eyepiece for viewing, and required using a monitor to view the image.

VCOM Systems

- The VCOM Systems provided such a narrow angle of view that is was difficult to obtain images of the retina without movement or blurring due to the handheld nature of the instrument. Did not expect village CHA/Ps to obtain anything they could use, since the group of optometrists even had difficulty doing it.

Comments

- More interested in using the equipment with their slit lamps for obtaining images to track patient changes with time. Hope the Welch Allyn equipment will clip on their existing slit lamps without any problem. We checked throughout ANMC to find a slit lamp to which the Welch Allyn would clip to the eyepiece, and only found 1 in 8 slit lamps that would work. It was not tested to see if the image was any good - just tested fitting the optical coupler to the eyepiece.
- All agreed that they would like to have the villages send in pictures of the external portion of the eye, to show damage following injury. Would like to see an image that captures both eyes. Tried to do this with the coupler from the Welch Allyn equipment - but the angle of view is too narrow that it is difficult to capture an image of one eye, let alone both eyes.

Summary

Caveats

Testing was conducted on representative video otoscope units supplied to ANHB by MedRx, AMD (Welch Allyn), JEDMED Instrument Company, and VCOM Systems. In all cases, the manufacturer representatives agreed to supply us with these units for evaluation purposes, with no commitments attached. Be aware that all results were determined from a single unit provided by the manufacturer, and no attempt was made to verify the repeatability of these results on multiple units. We do not claim these results are absolute, nor do we claim they will not vary when tested by others.

The unit provided by JEDMED arrived too late to do a complete set of tests. Moreover, we were notified by JEDMED that the unit we returned after testing had a misalignment of the light bulb source and the fiber optic cable assembly. It is not clear if this misalignment occurred during the shipping back to JEDMED or during the shipping to us. In the latter case, we tested a unit that was not functioning according to manufacturer's specifications. JEDMED has warned us that the misalignment would result in poor gain control, grainy pictures, poor illumination of the target, etc. We attempted to get the unit back for further trials, but JEDMED has only got the one "pre-manufacturing" unit.

MedRx supplied a sample of a short probe to another customer, who loaned that scope to us for some additional testing. We found that particular probe provided sharper images than the probe we tested and reported in this paper. Despite constant cleaning and every attempt to obtain clear images, the sharpness of the image varied greatly between probes. Consequently, MedRx may have probes of varying quality and these results are only indicative of one such sample.

AMD supplied two demonstration units at different times. The first unit was optimally tuned for ear images and exhibited minimal blooming and very accurate gain control and color accuracy. That unit had to be returned for other demonstration purposes before these tests were conducted. The second unit we obtained was not tuned optimally for ear images prior to shipment and was tested in this mode. Consequently, the AMD test results reported here may improve with a properly tuned system, and may be considered to be "worst case" results.

Resolution

Tests were conducted to test the resolution of various components of each the video otoscope systems supplied by the manufacturers. The purpose of the tests was to determine the resolution of the entire otoscope system, and to determine the limiting factor in each system. The first tests were conducted solely using the camera (and CCD sensor and electronics), replacing the entire optical path with a high resolution 50mm lens; these tests removed the limitations of the probe or coupler supplied by the manufacturer and provided information about the capabilities of the electronic components of the system. A second set of tests was conducted without the 50mm lens but with the optical coupler supplied by the manufacturers. A third set of tests was conducted using the entire system supplied by the manufacturer. The field of view of the system was also tested for this configuration. Note that not all tests were conducted on all systems, since some systems did not require an optical coupler and some systems could not accept the 50mm lens.

All resolution tests indicated that the horizontal resolution attained using an S-video output (when available) was typically 30-40% higher than that attained using composite output. It is no surprise, therefore, that the lowest resolution system was provided by MedRx and offered only composite

output. This was clear from the first tests on resolution using the 50mm lens, where the Welch Allyn camera provided a higher line resolution (455h x 350v) than the MedRx camera (358h x 325v).

The resolution figures obtained in the first tests using the 50mm lens should represent upper limits for each manufacturer since the optical pathway is close to "ideal". Replacing the 50mm lens with the manufacturer's optical coupler reduced the resolution on the Welch Allyn system (423h x 325v). Both the JEDMED and VCOM systems achieved higher resolution with their couplers (both at 488h x 325v) than the Welch Allyn system. However, the resolution figure for the JEDMED system was only valid at the center of the image due to the severe distortion introduced by the coupler at the edge of the image. The Welch Allyn coupler also introduced some edge distortion, but the VCOM coupler produced a clear edge-to-edge image.

Both JEDMED and Welch Allyn obtained the highest resolutions in the final tests using the entire system (camera and otoscope probe). The JEDMED system attained the highest horizontal resolution (476h x 273v) near the center of the image, but it was unclear how much the resolution was reduced off-center. The Welch Allyn system attained a lower horizontal but higher vertical resolution (430H x 309v). The 10% uncertainty in these values makes it difficult to claim that one is truly better than the other. However, both were better than all other systems tested, including the MedRx short probe system (347h x 243v), the MedRx long probe system (319h x 245v) and the VCOM system (370h x 195v).

Dot Resolution

It is not reasonable to draw conclusions about the quality of a video otoscope system just in terms of resolution without also considering the field of view of the system. A system with an extremely high-resolution camera is useless if the otoscope probe projects an image onto a very small portion of the CCD sensor of the camera. The ideal system would have a high resolution camera and a distortion free optical pathway that projected an image onto the entire surface of the CCD sensor. Consequently, this section attempts to draw conclusions about the image obtained from each system in terms of both resolution and the field of view.

The combination of resolution and field of view was termed "dot resolution", and is indicative of the number of distinct "dots" that the system can successfully capture in an image. Consider a system that attains a resolution of 400h x 200v, for example, but projects that image onto only 50% of the CCD sensor. The 400h x 200v resolution implies the system can image 800,000 "dots" (=400x200), but since only half the CCD sensor receives the image, the image output has a final "dot resolution" of only 40,000 dots (=0.5x80,000).

The Welch Allyn system attained the highest dot resolution of 78,000 dots due to a combination of high system resolution and a large image projected onto the CCD sensor (58.9% of surface). The JEDMED system, with a comparable system resolution, attained one of the smallest dot resolutions at 36,000 because the image on the CCD sensor was so small (occupying 27.7% of the surface, almost half the size of the Welch Allyn system). The MedRx system, despite the lower resolution, produced an image as large as the Welch Allyn system and consequently had the second highest dot resolution at 50,000 for the short probe. The VCOM system, through a combination of a small image (occupying 36% of the CCD sensor) and low resolution, achieved the smallest dot resolution at 26,000 of all systems tested.

Electronics

The electronics supplied with each system were tested for the ability to adjust to different levels of illumination (gain control), produce true color output (color accuracy), and adjust to images with high contrast and reflective surfaces (blooming). Overall, the electronics supplied with the Welch Allyn equipment was far superior to that supplied by other manufacturers. The Welch Allyn

equipment never needed the light intensity to be adjusted when taking any pictures - the video electronics adjust the camera gain over the complete range of light conditions tested. The color accuracy of the Welch Allyn was judged to be better than all other systems - both in terms of lab tests using a MacBeth color chart and by clinicians viewing the captured images. Finally, the Welch Allyn system exhibited virtually no blooming from reflective surfaces.

The camera and electronics supplied with the other systems were incapable of the range of gain control afforded by the Welch Allyn system. The MedRx system adapted poorly to varying illumination levels and exhibited some blooming. Clinically, this meant that the light intensity for the MedRx unit had to be adjusted on a regular basis in the ear canal depending on the earwax and other factors - making it difficult for a single person to work the unit. The output of the JEDMED was slightly better than the MedRx unit. While it did not suffer from blooming, it was unable to adapt to poor lighting and tended to exhibit washed out colors under bright lighting.

Optics

A variety of optical tests was conducted on the complete otoscope systems to determine the angle of view, depth of field, and presence of distortions. An ideal system would have a wide angle of view at the tip of the probe (typically >40°) to be capable of capturing a single image that encompasses the entire tympanic membrane, yet have a large depth of field and minimal distortions.

The angle of view for both the Welch Allyn and MedRx systems was 76°, sufficient to capture the entire tympanic membrane and a portion of the ear canal in a single image. The angle of view for the MedRx system may be less, depending on the apertures used in the system, and could drop as low as 59° which is still sufficient for otoscopy purposes. The JEDMED system had a narrower but sufficient angle of view of 44°. The VCOM system achieved an angle of view of only 13°, which means that a picture can never be obtained of the entire eardrum. Multiple pictures would have to be obtained and transmitted for a single telemedicine event, which was deemed unrealistic. A physician described the device as "hopeless" for this single reason.

The depth of field was determined as the range over which an object may be moved from the tip of the probe but still remain in focus. The JEDMED system had the greatest depth of field, maintaining a well-focused image of an object positioned anywhere between 1/4" and 1.5" of the probe tip. The Welch Allyn system had a slightly smaller depth of field, from 1/4" to 1". The MedRx system had an even smaller range of 1/4" to 1/2", and the VCOM system was the smallest at 1/4" to 3/8". Objects outside these ranges required the user to manually focus (for JEDMED, Welch Allyn and VCOM) the image, or the image lost focus (MedRx) if no manual focus was available. This means the Welch Allyn or JEDMED systems are more likely to generate an "in focus" image over a wider range of patients (with varying distances to the eardrum due to curvatures of the ear canal) than the MedRx equipment.

The amount of distortion generated by each system was not quantified, but distortion was certainly noticeable in many of the test images. Some distortion was noticed at the corners of the resolution tests using only the coupler with the Welch Allyn and JEDMED cameras. Most of this distortion is not noticeable when using the scope because the scope image is circular and the corners are not included in the final image. Some distortion did appear when using the probe due to asymmetries in the probe optics. Both the Welch Allyn and JEDMED systems produced normal barrel distortion (to be expected from the wide-angle nature of the probe) but also had a very symmetric image output; both the circumference to the image and the illumination pattern across the entire image were very symmetric. The VCOM system produced no significant barrel distortion (having virtually no wide-angle view) but produced an off-centered image on the CCD sensor with an asymmetric light pattern that dimmed at one edge. The MedRx system produced the most distortion, with optics that appeared misaligned and an illumination pattern that did not completely fill the image area.

Clinical Tests

In terms of inserting the devices into the ear for obtaining pictures, we received mixed results from a variety of clinicians. Only a few general conclusions were common to all reviewers. All users felt the VCOM system was not adequate for telemedicine use due to its inability to capture one single image of the entire tympanic membrane. All users recognized the limited gain control of the MedRx system, having to adjust the light intensity at some point during the examination. In all cases, the reviewers felt the poorer gain control required a more frequent light adjustment that made the MedRx unit more difficult for one person to manage. Generally, most users preferred the colors in the Welch Allyn system, and felt that system provided the sharpest and most accurate images.

The reviewers were split over the issue of ergonomics. Some felt the MedRx was easier to use due to it's smaller size and lighter weight, although we received reports that the Welch Allyn equipment was easier to use and easier to stabilize against the patient's head. The limited review of the JEDMED was not as complimentary, with users complaining about the stiffness of the cable.

We asked reviewers to consider the need to use smaller (pediatric) specula on the otoscopes. Many clinicians remarked that they only use 2.5 mm specula in rare cases, but we observed that these clinicians were able to obtain markedly better images using the 2.5 mm speculum because they could place the probe farther into the ear canal. We attempted to evaluate the video otoscopes on children, and recognized that the size of the specula is extremely important in determining whether the otoscope can be placed comfortably in the patient's ear. In clinical trials, the MedRx 3 mm speculum could not be placed in some young children's ears whereas the Welch Allyn 2.5 mm speculum could. Health Aides noted that some villages may not have running water, and the "non-disposable" nature of the MedRx and JEDMED speculum may prove to be a problem if these units cannot be sterilized or cleaned. These are expensive speculum. The Welch Allyn specula are disposable and already available in all villages.

Other Features

We understand that pneumatic otoscopy is one of four standard tests are conducted during an ear exam by CHA/Ps. This means that the otoscope unit must be capable of having an attached insufflator bulb and corresponding airtight seals to permit the puff of air from the bulb to be directed at the tympanic membrane. MedRx does not offer this option, whereas this is a standard feature on both the Welch Allyn and JEDMED equipment.

All three manufacturers supply other scopes that may be used with the base unit. JEDMED, for example, manufacturers 16 different heads that may be attached to the VSS unit (Video Scope System). Due to the proprietary coupling, no other manufacturer's heads may be attached to the unit. Both MedRx and Welch Allyn manufacture other scopes in addition to the basic otoscope probe, but both systems also utilize C or CS mounts and therefore any lenses with these mounting types may be attached to the camera. In addition, both provide a coupler that allows the camera to be attached to a standard scope with a specific type of eyepiece (onto which the coupler attaches).

We are still unclear about the FDA approval of each video otoscope system. Welch Allyn claim their system "... carries full FDA review and approval for use as a medical device to capture images of the ear, nose and throat in human subjects for consultation and diagnostic purposes." That is a stronger statement than a letter provided by MedRx from the FDA stating that the FDA has "determined the device is substantially equivalent to devices marketed ... but it does not mean that the FDA approves your device". We do not know the status of FDA approval on JEDMED or VCOM equipment.