

Secure Collaborative Telemedicine in Rural West Virginia

R. Reddy¹, R. Raman¹, S.M. Reddy¹, K.J. Cleetus¹, W. Hunt¹, I. Lapshin¹, W.R. Beam, MD, FCCP²,

B. Merkin, MD³

¹Concurrent Engineering Research Center, West Virginia University, ²St. Mary's Hospital,

³Valley Health Systems, Inc.

rar@cerc.wvu.edu

There is widespread access to distributed information services via the Internet and the World Wide Web. However, due to concerns about transmitting health information over the Internet, the practice of telemedicine was primarily conducted over dedicated communication networks.

Our project's primary objective was to demonstrate the viability of secure clinical telemedicine on public networks and show that its adoption as an integral part of an overall health care plan could result in cost savings and improved access to quality health care for rural populations. We present herein the results of our research during the period 1996 to 1999.

Building on our earlier work in Web-based access to distributed medical records¹, we set out to investigate technical measures through which we could protect electronic health information in our telemedicine applications. On the basis of recommendations and practices², open standards, and emerging technologies, we developed a secure collaborative telemedicine architecture (SCTA).

SCTA supported portable measures for identification and authentication of health care providers via smart cards and public key cryptography, encrypted health care communications, role-based access to distributed health care information services, and remote access to patient vital signs. We developed smart-card applications³ to authenticate health care providers and to provide a portable emergency medical record for patients⁴, with links to the patient's online electronic medical records.

We developed three categories of telemedicine applications.

Secure Telemedicine for Intensive Care Unit (ICU) Providers (Pilot Site: St. Mary's Hospital, Huntington, WV)

This application enabled intensivists who were away from the hospital (in their clinic or at home) to review their patients' medical reports and bedside monitor data. A wireless local area network in the ICU and a mobile videoconference cart enabled communications with ICU staff members at nurse stations as well as in patient rooms.

Secure Telemedicine for Midlevel Providers (Pilot Sites: Valley Health System's Clinics in and around Huntington, WV)

Midlevel providers (e.g., physician assistants and nurse practitioners) and their supervising physicians were provided with collaboration tools for videoconferencing and review of patient chart and real-time patient vital signs⁵, enabling remote supervision of diagnosis and treatment decisions. The system had applications for imaging, archiving, and reviewing paper-based records and a computer medical repository of transcribed reports.

Secure Telemedicine for Home Care Patients (Pilot Site: Monongalia County Health Department, Morgantown, WV)

This telemedicine application enabled home care providers to augment onsite visits to their patients' homes with telemedicine-based "televisits," which improved their ability to check on the conditions of patients with chronic ailments. The system employed set-top boxes in patients' homes to support

videoconferences over telephone lines via the H.324 standard.

We deployed the telemedicine systems in a phased manner at pilot sites in and around Huntington, WV, and in Morgantown, WV. Some of these systems were also demonstrated to a wider audience at technical conferences⁶ and forums and gained favorable feedback.

We conducted evaluations to determine the effects of these secure telemedicine applications on quality of care, access to care, and the cost of health care delivery as well as to assess the measures to protect the security and integrity of medical records. Our assessments were guided by recommendations published by the Institute of Medicine⁷. Surveys were conducted at the beginning of this project, and data were collected during the course of deployment of the telemedicine systems at pilot sites. In some cases, the information collected was too small, and so our analysis was based on anecdotal observations.

The results of the deployment were varied, with the best usage and benefits occurring in the ICU scenario.

In the ICU telemedicine scenario, we were able to record cost savings using data from the hospital's APACHE report, which included 24 ICU patients of the participating intensivist and 65 ICU patients under the care of other intensivists. The study found a 30 percent drop in the normalized length of stay for the patients of the participating intensivist. However, these findings need to be validated by conducting the experiment over a longer period and involving a number of intensivists to eliminate the impact of confounding factors such as the degree of expertise of the physician.

In the midlevel provider telemedicine scenario, the supervising physician was able to sample a larger number of medical

charts of the midlevel provider's patients. The increase in chart reviews—online plus onsite—could result in improved quality of health care delivered. Costs will be reduced since one physician will be able to supervise more midlevel providers. And rural patients will have increased access to health care through the supervising physician's ability to review their charts and recommend timely medical interventions. Although we were able to establish technical feasibility and provider acceptance, this experiment did not continue long enough to collect data to quantify the benefits of all aspects of the system.

The home care telemedicine system was deployed at the home care agency and at the homes of two patients who were selected on the basis of a set of predetermined criteria. Surveys were conducted after the deployment, but the sample size was too small for statistical analysis. The patients were comfortable with the manner of the televisits, found the videoconference system easy to operate, and wished to increase the frequency of visits by this method. Though the quality of the images was not good enough for any diagnostic purposes, they helped the nurses monitor the progress of a patient's wound over time. It was felt that about one-third of the physical visits could be converted to televisits through such a system.

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