U.S. DEPARTMENT OF COMMERCE
National Telecommunications & Information Administration

Evaluation of the
Telecommunications and Information Infrastructure Assistance Program

Case Study Report

Comanche County Memorial Hospital
94015

Lawton, Oklahoma
Report Revised: August 31, 1999

Site Visitors: John Lockwood and Katherine Sharp

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PREFACE

On behalf of the National Telecommunications and Information (NTIA), I am pleased to share the following report that is one of a series of case studies conducted on grants awarded by the Telecommunications and Information Infrastructure Assistance Program (TIIAP) in 1994 and 1995. The case studies are part of the program's evaluation effort designed to gain knowledge about the effects and lessons of TIIAP-funded projects. NTIA contracted Westat, a research and consulting firm, to perform an independent evaluation of the program's first two years of grants. The evaluation consisted of a mail survey of 206 grant recipient organizations and in-depth case studies of selected projects. In February, 1999, the Commerce Department released Westat's evaluation report.

The projects selected for the case studies cover a broad range of program types and sizes, planning grants as well as demonstration grants, and they show varying degrees of implementation, sustainability, and replication. Westat selected the projects to represent a cross-section of all projects funded in the program's first two years. Specific selection criteria included geographic region, target population, project application area, project category, and size of award. To conduct each case study, Westat reviewed all project files, including progress reports and the final report, and conducted site visits. The site visits consisted of project demonstrations and interviews with project staff, representatives of partner organizations, and project end users.

NTIA thanks the case study participants for their time and their willingness to share not only their successes but their difficulties, too. Most of all, we applaud their pioneering efforts to bring the benefits of advanced telecommunications and information technologies to communities in need. We are excited about the case studies and lessons they contain. It is through the dissemination of these lessons that we extend the benefits of TIIAP-funded projects nationwide.

We hope you find this case study report valuable and encourage you to read other TIIAP case studies. You may obtain additional case studies and other TIIAP publications, including the final Westat evaluation report, through the NTIA web site (www.ntia.doc.gov) or by calling the TIIAP office at (202) 482-2048. We also are interested in your feedback. If you have comments on this case study or suggestions on how TIIAP can better provide information on the results and lessons of its grants, please contact Francine E. Jefferson, Ph.D. at (202) 482-2048 or by email at fjefferson@ntia.doc.gov.

Larry Irving
Assistant Secretary for Communications and Information

Comanche County Memorial Hospital

A. EXECUTIVE SUMMARY

The purpose of this TIIAP grant to Comanche County Memorial Hospital (CCMH) was to promote rural health care through telemedicine. Teleconferencing, teleconsulting, teleradiology, and distance education were all part of the program to improve the quality of health care for rural residents. This was done through a partnership between CCMH and First Health West (FHW), a consortium that included 8 rural publicly operated hospitals and 30 clinics. With TIIAP funds and additional funding from the Oklahoma Telemedicine Network (OTN), CCMH connected 22 hospitals and clinics, all with teleconferencing, 6 with teleradiology, and 3 with remote cardiac monitoring capabilities. The direct end users were hospital personnel at the rural sites and CCMH.

A distance learning component, continuing medical education (CME), was also developed during the grant period. The sites' medical staff participated via the teleconferencing equipment bought with TIIAP funds. The "Doc Talk" program, a regularly scheduled teleconference, allowed doctors to keep up to date about new treatments for common ailments. Other programs included diabetes education for nursing staff as well as patients and family members suffering from the disease. Reportedly, "more than a thousand hours of participation in health education" were logged for CME during the grant period.

Prior to the TIIAP grant, there was little progress in developing the telecommunications infrastructure of southwestern Oklahoma. In 1994, the year of the TIIAP grant, there was no significant telecommunications in the area. This may have led to an important barrier faced by the project staff—lack of user buy-in. Reportedly, personnel at the rural sites are resistant to change, and this has negatively affected the project. Although hospitals have the equipment and the lines secured to transmit medical data, the new technology is not being used as much as it could be due to the resistance.

User resistance also may be linked to the complexity of the technology, lack of training, and payment issues. The training requirements for telemedicine are quite substantial. Personnel in the rural sites must know how to fill out the proper paper work, be familiar with the equipment, and know the different procedures involved. In the beginning of the project there was a person designated to train people at the sites and the people who received training were supposed to pass the knowledge on to others that needed to use the system. More recently, however, training has been an issue for sites. This has been true for two reasons, the logistics involved and personnel turnover. Because of the distances between sites and the time required to travel, training is conducted sporadically on an as-needed basis. In addition, personnel turnover has plagued the project, and as a result, the difficulty in maintaining a trained staff has been amplified. Finally, an ongoing issue for telemedicine projects is who gets paid for services rendered. Although some telemedicine systems do not compensate users, Oklahoma passed a law that patients can be billed for telemedicine services. There may, however, still be some lingering user resistance because of this issue.

Although the project may not be a complete success because of the issues with user buy-in, the outlook for telemedicine is still positive at CCMH. Those interviewed seem to agree that telemedicine has become an ongoing part of treatment in southwestern Oklahoma. Teleradiology will continue and is expanding to include CT scans. Remote cardiac monitoring also seems to be part of the ongoing services offered through CCMH. The short fall is in the use of the teleconferencing capabilities at rural sites. There

were no plans to use the teleconferencing capabilities of sites for teletherapy or teleconsultations in the near future; however, the equipment may be utilized for CME and health education for the public.

Lessons from the project activities include:

- Lease; do not buy equipment—because technology changes so rapidly, it may serve a project better to lease equipment instead of buying it outright.

- Establish relationships—people are a key element and constant communication to keep them motivated and in the loop may facilitate real buy-in from users.

- Tackle payment issues early—it is important to clear up misconceptions about payment early, which may further facilitate physician and personnel buy-in.

- Maintain stable lines—at a minimum, T1 lines are needed for telemedicine; broadband ISDN lines are better.

- A good technical help desk is a necessity—telecommunications technology is a complicated technology and as such is prone to complex problems.

B. OVERVIEW

Purpose and General Approach[1]

This award was a 2-year demonstration grant that extended from October 1994 to October 1996. The purpose of the TIIAP grant to Comanche County Memorial Hospital (CCMH) was to promote rural health care through telemedicine. Teleconferencing, teleconsulting, teleradiology, telecardiology, and distance education were all part of the proposed program to improve the quality of health care for rural residents. As stated in the proposal,

The primary long-range goal will be the continuous improvement of health services to the rural underserved population by removing obstacles that prevent or slow access to high quality health care. The immediate goal is to establish CCMH as the hub of medical expertise linked to 8 rural hospitals and 14 rural clinics in an information network that will include mechanisms for interactive video, distance learning and continuing medical education, and peer collaboration that will be rural-practitioner driven.

The Comanche County Memorial Telemedicine Project is an outgrowth of an information systems plan that began in November 1991. This plan was the beginning of the regional telemedicine network dubbed the First Health West Telemedicine Network, which came online in October 1994 with the help of TIIAP funds. Comanche County Memorial Hospital (CCMH) formed a partnership with First Health West to expand Southwest Oklahoma's access to quality health care through the implementation of a state-of-the-art telemedicine program that links hospitals and other health providers to make available a full range of telemedicine, clinical, and administrative support services to urban and rural health care providers in

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[1] Due to turnover, there has been a problem in securing complete details about the project. The original director and the technical trainer were two key people that left the project, and as a result, some information is incomplete or unavailable.

southwestern Oklahoma. It was designed to give rural health care providers access to clinical specialties as well as financial and clinical databases that are normally found only in large health care facilities. The telemedicine network also provided users with secured access to an array of management information systems.

Through the network, end users can access and use information from any workstation within the hospital. For example, authorized staff can obtain patient demographic or hospital financial information. A nurse or physician can immediately retrieve a patient's drug profile, laboratory test results, or a radiology report. This can be done from a nursing unit, the physician's office, a remote clinic, or even the physician's home. Teleradiology can be performed, i.e., patient x-rays in rural hospitals are digitized, transmitted over the WAN, and interpreted by a CCMH radiologist. Rural physicians can query medical journals located on CD-ROM in the CCMH Medical Library or even access databases from the National Library of Medicine. In addition, by using interactive video, diabetes patients in rural communities can attend insulin injection classes or receive nutrition counseling from a CCMH clinician. Telecardiology, remote cardiac monitoring that allows cardiac patients to be retained in the local hospital (near their home and family) while being monitored by specially trained technicians with immediate access to a cardiologist, is also available. The telemedicine project provides all of these services to rural hospitals over a single digital communication circuit. These circuits are "fractionated" into 24 channels. These channels are dedicated to transfer data, video images, or voice traffic.

At the time of the TIIAP grant, the Comanche County Memorial Telemedicine Project was an innovative approach to the delivery of telemedicine and information management services. Indeed, the network continues to utilize a dynamic allocation of bandwidth to permit the simultaneous transmission of voice, data, video, and cardiac monitoring signals over T-1 lines in a hub and spoke configuration. By consolidating multiple services on the same communication circuit, telecommunication costs per application and transaction are reduced.

The network is used by physicians, nurses, and technicians on a daily basis in the support and delivery of health care. These 500 users are located at 22 sites throughout a 13-county area covering nearly one-fourth of the state of Oklahoma. Commanche County Memorial Telemedicine Project hospital/clinic workstations, terminals, and host computers are connected to a campus-wide Ethernet that is 10BaseT and fiber optic based. Remote data and video/voice communication is facilitated using a combination of multiplexed T-1 circuits and voice grade telephone lines.

Description of Grant Recipients and Project Partners

CCMH is a 343-bed acute care facility located in Lawton, Oklahoma. It provides comprehensive cardiovascular care and has a pulmonary lab, the only catheterization lab in the area, and advanced diagnostic technology (e.g., MRI, CT scans, and nuclear medicine).

The primary project partner was First Health West (FHW), one of the first Urban-Rural HMOs. It was formed as a nonprofit trust in 1993 and includes CCMH, 8 rural publicly operated hospitals, and 30 clinics (12 located in Lawton). FHW serves a 13 county area covering almost 12,000 square miles and a population of over 300,000 Oklahomans. The only urban area within its jurisdiction is Lawton (pop. 80,561).

Presently, the partnership between CCMH and FHW is being dissolved due to a legal entanglement concerning their status as nonprofit trusts. It is against Oklahoma State law to have a private trust that includes another private trust, and since FHW includes CCMH, which is also a private trust, the

partnership is illegal and will be dissolved. This state of affairs will not affect the working relationship between the rural sites and CCMH. The site personnel interviewed expect the project to continue uninterrupted.

Other partnerships included the Oklahoma Department of Commerce (ODOC), which "obtained funding to create a state-wide electronic highway dedicated to medical applications," and the Oklahoma Telemedicine Network (OTN). The OTN is a statewide telecommunications network created by ODOC funds that links multiple rural health care facilities to regional medical centers. This telemedicine network is a peer-to-peer network linking medical facilities of all types (e.g., hospitals, clinics, private practice, and medical schools) to facilitate the rapid exchange of medical information in a digital format. OTN has helped 45 hospitals get equipment and pay for line charges to set up telemedicine throughout the state. The focus of the OTN program was teleradiology. The initial funding of OTN came from the ODOC through a Community Development Block Grant (CDBG) totaling $3.7 million dollars. The ODOC partnered with the University of Oklahoma Health Sciences Center, which was responsible for the project research, design, and implementation of the network. Thirty-eight rural hospitals were funded in the initial network set up, with an additional seven rural hospitals funded by another CDBG. The synergy of OTN and TIIAP funds helped establish the current telemedicine network in southwestern Oklahoma.

Project Costs

The total project budget was reported to be $993,275 with $496,637 (50 percent) provided by TIIAP. The matching funds were provided by the CCMH/FHW partnership and an OTN grant.

C. PROJECT CONTEXT

Community Description

The project area comprises 13 predominantly rural counties in southwestern Oklahoma. The area covers 11,680 square miles and include the counties of Caddo, Comanche, Cotton, Custer, Grady, Greer, Harmon, Jackson, Jefferson, Kiowa, Stephen, Tillman, and Washita. According to the grant application, the total population is 337,928 with almost three-quarters living in rural areas; the sole urban area is Lawton. Overall the population is 75 percent white, 8.7 percent African American, 6 percent Native American, 5.4 percent Hispanic, and 5 percent Asian American or other ethnicity. The age distribution is:

	Age		
	1-19	31.0 percent
	20-44	37.1 percent
	45-64	17.9 percent
	65+	14.0 percent

Poverty rates run high in the region, with 59,608 poor and 247,776 near-poor/low-income residents. There were 44, 072 people on food stamps at the time of the TIIAP grant. Almost 10 percent of hospital admissions had no insurance, 13 percent were covered by Medicaid, and 64.4 percent by Medicare. Except for Custer and Grady, the other 11 counties were designated Medically Underserved Areas. Caddo, Jackson, Tillman, and Washita were designated Primary Medical Care Health Manpower Shortage Areas, where the shortage of primary care physicians and the absence of specialists are major barriers to quality health care.

During the site visit, evaluators interviewed personnel at two sites, the hub hospital in Lawton and a rural hospital in Frederick. Lawton, Oklahoma, was founded in 1901 when the Kiowa-Comanche Indian reservation was opened for white settlement. Lawton is the third largest city in the state and is the retail and distribution center for the area's cattle, dairy, and agricultural industries. It is also the home of manufacturing and processing companies. A recent study by Arizona State University placed Lawton and Comanche County among the nation's 20 fastest growing small markets. Major cities located nearby are Oklahoma City, 90 miles northeast, and Dallas/Fort Worth, which is 155 miles to the southeast of the city.

Health care is a primary focus in Lawton, and the city has taken steps to offer state-of-the-art medical services. Because of its location in the center of southwest Oklahoma, Lawton has become the health care hub for surrounding communities. It has two public hospitals, an Indian hospital, and a brand new military hospital, with numerous other clinics and health care facilities (such as nursing homes) that offer a wide range of services.

Data from the 1990 census place the Lawton population at 80,561. Almost three-quarters (72 percent) of the Comanche County population reside in Lawton. City demographics breakdown as approximately 71 percent White, 19 percent African American, 3 percent Native American, and the remaining 7 percent all other races. Lawton has 46 primary and secondary schools with approximately 18,500 students and 1,200 teachers. It is also the home of Cameron University, a 4-year liberal arts university.

Lawton presently has a significant start in housing a state-of-the-art telecommunications infrastructure. Southwestern Bell supports a network that includes a Northern Telecom DMS 100/200 Super Node digital switch. The DMS is capable of supporting special needs such as FTS 2000, auto van, and integrated services digital network (ISDN). In addition, it is capable of bulk data transfers, video transmission, and packet switching. The switch is interconnected with Oklahoma City, Duncan, Fort Sill, Altus, and Walters with fiber optic cable. Lawton's Central Office facilities have a 100,000-line capacity, 57 percent of which are available.

The City of Frederick in Tillman County, a rural community the site team visited, has a population of 5,221. Slightly more than half of the Tillman County population resides in Frederick. The demographics of Frederick are approximately 70 percent White, 13.5 percent African American, 4 percent Native American, and the remaining 12.5 percent all other races. The Tillman County labor force was 4,040 in 1995.

Status of the Telecommunications/Information Infrastructure Environment Prior to the TIIAP Project

Prior to the TIIAP grant, there was little progress in developing the telecommunications infrastructure for southwestern Oklahoma. As the proposal stated, "currently, there is no system nor network of information services in existence in the targeted service area."

D.   PROJECT IMPLEMENTATION

Activities/Milestones That Occurred Prior to the TIIAP Grant Period

In November 1991, CCMH developed an Information Systems Plan and began rebuilding and reengineering its information systems infrastructure. The intent was to improve the delivery of health care, enhance patient and provider education, and provide clinical specialty services to the citizens of southwest Oklahoma. The result of this effort was The First Health West Telemedicine Network, which came on line in October 1994. Prior to this, the bidding process for equipment was begun. Designing telemedicine rooms and scheduling for continuing medical education (CME) and user training seminars were also started prior to the grant period.

Activities/Milestones That Occurred During the TIIAP Grant Period

- **Connected rural sites**—Connected 22 rural sites to the hub, CCMH, via T-1 lines. All of the sites have videoconferencing capabilities and remote cardiac monitoring is possible at three rural sites, Carnegie, Frederick, and Waurika. For the first 6 months of 1997, 79 cardiac patients were monitored around the clock for an average of 2.83 days each. Teleradiology is also available at six sites (Carnegie, Frederick, Waurika, Hollis, Mangum, and Cordell). In the most recent month (January 1998), there were 138 teleradiology cases (see Appendix A for more details).

- **Training—**Oriented administrators, support staff, and physicians to telemedicine concepts and procedures. The project also provided technical training to the rural and hub site personnel. Due to the departure of the project's trainer and original project director, exact details and figures on the number of people trained are unavailable.

- **Telemedicine applications**—Telemedicine applications such as telecardiology, teleradiology, and teletherapy were performed during the grant period. Remote cardiac monitoring took place in three rural hospitals, and speech therapy via videoconferencing helped one patient who was unable to travel. Although teleradiology is credited more to OTN funding, it utilized the infrastructure supplied by the TIIAP grant.

- **Continuing medical education (CME)**—Medical staff used teleconferencing equipment to participate in CME. The "Doc Talk" program, a regularly scheduled CME teleconference, allowed doctors to keep up to date about new treatments for common ailments. Other CME programs included diabetes education for nursing staff and patients suffering from the disease. Reportedly, "more than a thousand hours of participation in health education" were logged for CME during the grant period.

Steps Taken to Sustain Project Activities Beyond the TIIAP Grant Period

There has been some investigation into seeking future funding, but the bulk of it will likely come from the hub hospital. There is anticipation, however, that rural hospitals will begin to pay for some of the costs associated with telemedicine, e.g., line charges. The problem is that many rural hospitals cannot afford to pay for the telemedicine services, so this is being explored on a case-by-case basis. The individuals interviewed hope that the state will also contribute funds, but this is not certain.

Activities/Milestones That Occurred Following the TIIAP Grant Period

Since the end of the grant period, CT scans have been added to the range of telemedicine services provided by CCMH. Other services such as teleradiology and remote cardiac monitoring are being maintained at previous levels. There have been discussions about expanding telemedicine into the areas of prenatal care and drug abuse prevention, but these applications are still in the planning phase.

Issues

- **Skills needed by end users**—According to the Director of Telemedicine at CCMH, the training requirements for telemedicine are quite substantial. Personnel in the rural sites must know how to fill out the proper paper work, be familiar with the equipment, and know the different procedures involved. These rural health technicians must fill out a form that is much like a fax cover sheet with different codes for the various injuries that might require an x-ray. After this is done, they call the CCMH to alert them that an image is being transmitted. Then, they feed the film image into a digitizer and send it to CCMH for viewing. If there is a problem, the personnel must be capable of performing basic diagnostics. Personnel at the hub (CCMH) must receive the image and route it to the designated physician for viewing. This necessitates a working knowledge of the system and the software as well as the systems support procedures in case the images are not received or transmitted properly.

- **Training**—In the beginning of the project there was a person designated to train people at each site, and these people were supposed to pass the knowledge on to others that needed to use the system. This train-the-trainer approach was successful in the beginning and helped the project begin operation. More recently, however, training has been an issue for sites. This has been true for two reasons: the logistics involved, and personnel turnover. Because of the distances between sites and the time required to travel, training is conducted sporadically on an as-needed basis. There is no online help available, so training is often given face to face. Since personnel turnover has plagued the project, quality training has not been a strong point.

- **Protection of privacy**—Although privacy is often an issue for telemedicine projects, it has not been a barrier for CCMH and its affiliates. Since images are transmitted on an encrypted backbone from hospital to hospital, they are secure. They in essence become internal documents with limited access on both ends. These images are not Internet accessible and are as protected as facsimile transmissions from one site to another.

- **Interconnectivity**—Some software packages simply do not work with each other. This can be a delicate issue when hubs need to cooperate or a system upgrade is planned. In Lawton, this has hampered cooperation with other hub sites not using the same system. In addition, issues of interconnectivity have made the prospect of upgrading the system at CCMH an expensive proposition.

- **Payment for services**—An ongoing issue for telemedicine projects is who gets paid for services rendered. Although some telemedicine systems do not compensate users, Oklahoma passed a law that patients can be billed for telemedicine services. According to project staff, Medicare does not reimburse for telemedicine, and until Medicare does it will be difficult to fund. Project staff stated that this is a major stumbling block for telemedicine.

Problems

Problems with getting rural end users to utilize the technology have been the project's greatest barrier to success. Numerous interviews told the tale of rural resistance to technology. The project director illustrated the problem through analogies of Newtonian physics, "a body at rest tends to stay at rest and requires much more force to generate movement than a body already in motion." In other words, people in the rural areas are resistant to change and it is difficult to get them in motion towards technological development. Although hospitals have the equipment and the lines set up to do the job, the new technology and procedures are not being used as much as they could because of a kind of inertia. Health care workers in the region are apt to do things in a traditional manner and are resistant to changing these set patterns.

There were many stories told of rural sites not using the equipment. For example, a site would have a problem with the hardware and simply turn it off. The site would not report the problem so it would not be discovered by technical services until the monthly transmission figures were reviewed. Once project administrators at the hub realized that transmissions of data had ceased, they had to call the site to find out about the problem. Then, and only then, would a person be dispatched to service the equipment.

User resistance in southwestern Oklahoma likely happened for two reasons. First, there were personal ties to a regional radiologist that would visit rural hospitals twice a week. Folks at the hospitals liked the radiologist and established a relationship with him. Fears that teleradiology might put their friend out of a job may have led to resistance against using the available technology. Second, a lack of ongoing telemedicine training and being accustomed to a more traditional way of taking care of patients may also have led to an avoidance of using the technology.

Project costs are another problem. As new technology becomes available, sites are hard pressed to purchase it because of the overwhelming costs. The individual pieces of equipment are not only costly, but they must be compatible with the other hardware and software being used. The purchase of a new workstation at the hub site may require a new router, which in turn may require new software. A recent quote for a new workstation to upgrade the system at CCMH was $87,000. This new hardware will also require software, training, and a new router in addition to the quoted price. If CCMH wanted to set up a new site in a rural hospital (not already linked) it would cost approximately $200,000 plus training and line charges of $700 per month.

Storage for images is another problem. At this time there are no archives for images sent to the hub (except the original x-ray film). The problem is that tele-images take up so much disk space that they are deleted each day to make room for images the next day. For example, a CT scan has approximately 7,000 images per case. So, 20 cases will fill an 8-gigabyte hard drive. The costs associated with such storage are astronomical and thus, no archival storage is performed.

Turnover has been an ongoing problem for this project. As personnel gained experience with the technology, it made them more marketable in other areas. City lights and urban dollars lured several key members of the project team away. The original director and the technical trainer were two key people that left the project. Turnover at the rural sites also caused continuity problems and, in combination with the interruption in training, may have led to lower user buy-in.

E.   PROJECT ACCOMPLISHMENTS AND IMPACT

Technology-Related Accomplishments

Frequently, rural physicians must make diagnostic and therapeutic decisions with limited previous exposure or experience with a patient's problem. Often, the patient is transferred to a larger urban facility due to this lack of decision support. The patient is removed from his/her community and isolated from family, friends, and the primary physician with whom they have established a relationship. This results in a loss of revenue for the rural medical facility and significant inconvenience and stress for the patient.

To provide effective decision support, telemedicine provides e-mail, Internet access, and various hardware and software. These technologies enhance patient care in the rural setting by improving information access for rural physicians and providing specialist interpretation in several hours instead of 3 to 5 days. With the teleradiology system, rural hospitals can scan, send films, and receive typed interpretations on the same day. Emergency readings can be obtained usually within 30 minutes from the time films are sent. Telecardiology, or remote cardiac monitoring, is also possible at three rural sites to support the rural physician and ease the patient's burden. In addition, videoconferencing technology has been used to continue and enhance the medical expertise of rural doctors for common problems and perform therapy for needy patients.

The Comanche County Memorial Telemedicine Project has also encouraged greater use of the National Information Infrastructure (NII) by providing a model for other hospitals. Several Oklahoma hospitals and community health organizations have visited CCMH to see demonstrations of the network's integrated information management and telemedicine applications. CCMH has provided model to 12 other hospitals, the University of Oklahoma, Oklahoma State University, the United States Army Medical Service Corps, the Oklahoma Telecommunication Strategic Planning Committee, and a school board in Louisiana.

Impact of Project on Direct End Users

The original project director reported that the project's interactive video was reducing rural physicians' sense of isolation by allowing them to interact with urban specialists, and this was helping to improve CCMH physician recruitment and retention efforts. Indeed, from the site visit it was clear that physicians have been exposed to technology and CME through the project. However, many have been reluctant to buy in to the available technology. The current project director reported that only 10 percent of the region's physicians use e-mail. In addition, many doctors did not take advantage of the CME programs available. So in the long run, the impact on the end users has not been as great as it could have been.

The hospitals have also been positively impacted by the grant. Each morning CCMH senior management and department directors receive patient census and workload reports electronically. These timely performance indicators have been a useful tool in making operational decisions ranging from nurse staffing to cafeteria food preparation. Quantitative examples of this impact include:

- The project's order management, laboratory, radiology, pharmacy, and drug dispensing applications have resulted in an annual reduction of over $200,000 in lost charges for clinical tests and inpatient drug orders. This capability is being extended to rural community hospitals.

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- The partnership (CCMH and FHW) has developed telemedicine applications that reduce Medicare and Medicaid costs to HCFA while increasing revenue to rural hospitals. For example, 17 diagnostic-related group (DRG) 125 (circulatory disorder) patients were admitted to CCMH during 1994 from the Frederick area. The CCMH Medicare reimbursement rate for DRG 125 is $3,807, whereas the Frederick hospital rate is $2,907, reflecting a difference of $900. If these patients could have been retained in the rural facility, Medicare could have realized a saving of $15,300. The Frederick hospital would also have realized additional revenue of $49,419.

Impact of the Project on Other Beneficiaries and/or the Overall Community

The qualitative improvement in rural life was illustrated through stories about the people that this system helped. Patients in rural communities can "see" a cardiologist or attend diabetes education classes without having to miss a day of work or drive long distances to an urban health care facility. Thus, people could be treated in their own communities without the stress and expense of being transported to an urban hospital for care. For example, one narrative in particular involved a person who could not travel, yet received important therapy. A person in need of speech therapy after a tragic accident received treatment via a videoconferencing link between CCMH and a rural hospital. Other stories included those of patients that were saved from the burden of having to travel for x-rays and cardiac monitoring. Telemedicine in rural areas has been a vital link to the well-being of patients and quality health care.

Impact of the Project on Grant Recipients and Project Partners

The grant seems to have been instrumental in the continued survival of rural hospitals and clinics. In the health care area there is a trend to consolidate profitable hospital facilities and close down unprofitable ones. This is bad news for rural residents, because it is often their hospitals that are marginally, if at all, profitable. Many rural health care centers in southwestern Oklahoma are reportedly facing a similar fate, but telemedicine is helping. Using telecommunications technology keeps patients in rural hospitals for treatment and makes those facilities more financially viable. So both the hub (which can bill for services rendered) and the remote sites have benefited from the partnership.

Project Goals Not Met

Although all of the project goals were met, CME and teleconsultation are not currently being used as much as they could be. When the site visit team visited the rural hospital in Frederick, the teleconferencing equipment was available but idle. Reportedly, it would take a technician 20 minutes to make the equipment ready for a teleconference. Thus, teletherapy, teleconsultation, and other teleconferencing applications (such as CME) are not presently being used. This does not mean that applications using this equipment will not be forthcoming in the future, but for now, the videoconferencing equipment lies dormant.

Impact of TIIAP Support on the Initiative

TIIAP funding allowed CCMH to buy telemedicine equipment such as remote cardiac monitoring and videoconferencing equipment. Other funds from the state via OTN tended to be used for teleradiology and line fees. Indeed, the combination of the two funding streams (TIIAP and OTN) likely created a

synergy that fed telemedicine into the region much faster than would have occurred without the funds. Although teleradiology would have been available to rural hospitals through OTN funds, other telemedicine features such as telecardiology, teletherapy, and CME may not have come to fruition if not for TIIAP funds.

F.   EVALUATION AND DISSEMINATION

Evaluation

Data collection is taking place in Lawton as system usage is routinely recorded (see Appendix A for examples). An outside evaluator was commissioned to write the closeout report, but no stand-alone evaluation report was written. In addition, project personnel stated that much of the good being done was not measurable. That is, they were improving the life of rural residents, but this was not easily quantified. Money and travel time saved for residents is one possible way of measurement, but there are no efforts underway to track them.

Dissemination

Dissemination has been minimal. Although there have been stories in the Oklahoma newspapers about telemedicine, most news about the project is spread via word of mouth. Presently, CCMH does not have a website.

G.   LESSONS LEARNED

- **Lease; do not buy equipment**—because technology changes so rapidly, it may serve a project better to lease equipment instead of buying it outright. The project director suggested that this might be an area where TIIAP could consider changing its policy. If a project can lease instead of purchase equipment, it may be better able to adapt as technology changes and make a more seamless transition to improved technology.

- **Establish relationships**—a telemedicine project has to establish relationships and should not change referral patterns. People are a key element, and constant communication to keep them motivated and in the loop may facilitate real buy-in from users.

- **Tackle payment issues early**—telemedicine is so new that it is often not clear who will get paid for their services. The site reported that it is important to clear up misconceptions about payment early to further facilitate physician and personnel buy-in.

- **Maintain stable lines**—at a minimum, T1 lines are needed for telemedicine, and broadband ISDN lines are better.

- **A good technical help desk is a necessity**—telecommunications technology is complicated and, as such, is prone to complex problems. In southwest Oklahoma, this was exacerbated by the involvement of seven different phones companies operating in the CCMH telemedicine area. Good technical assistance will help solve problems and perhaps be able to determine which phone company has jurisdiction (in the case of a line problem).

H.   FUTURE PLANS

Plans to maintain the system as it is today are in place. There are no plans, however, to expand the system to other sites in southwestern Oklahoma. Costs and other problems have negatively affected telemedicine programs and as a result such programs (at least in the Lawton area) will likely not expand.

Although the project may not be a complete success because of the issues with user buy-in, the outlook for telemedicine is still positive at CCMH. Those interviewed seemed to agree that telemedicine has become an ongoing part of treatment in southwestern Oklahoma. Teleradiology will continue and is expanding to include CT scans. Remote cardiac monitoring also seems to be part of the ongoing services offered through CCMH. The short fall is in the use of the teleconferencing capabilities that rural sites have and this is troublesome. Although there was little evidence of using the teleconferencing capabilities of sites for teletherapy or teleconsultations, there are plans for CME and health education for the public to continue.

Telecardiology Statistics

October, 1997

Hospital:
 Carnegie   8 patients on for 21 days
 Fredrick   3 patients on for 6 days
 Waurika   1 patient on for 3 days

This totals 12 patients for 30 patient days or:
        2.5 days per patient and
        1 patient on the remote monitors per day.

November, 1997

Hospital:
 Carnegie   10 patients on for 27 days
 Fredrick   3 patients on for 12 days
 Waurika   2 patients on for 5 days

This totals 15 patients for 44 patient days or:
        2.93 days per patient and
        1.46 patients on the remote monitors per day.

December, 1997

Hospital:
 Carnegie   10 patients on for 27 days
 Fredrick   1 patient on for 3 days
 Waurika   5 patients on for 12 days

This totals 16 patients for 42 patient days or:
        2.62 days per patient and
        1.35 patients on the remote monitors per day.

Teleradiology Statistics

October, 1997

Hospital:	Cases:	Images:
Carnegie	115	249
Fredrick	73	147
Waurika	1	2
Hollis	3	7
Mangum	2	10
Cordell	1	4
Totals:	195	414

Average image per case:	2.1
Average images per day:	18.2
Average cases per day:	8.5

November, 1997

Hospital:	Cases:	Images:
Carnegie	67	145
Fredrick	83	167
Waurika	0	0
Hollis	0	0
Mangum	2	12
Cordell	14	31
Totals:	166	355

Average image per case:	2.1
Average images per day:	18.0
Average cases per day:	8.3

December, 1997

Hospital:	Cases:	Images:
Carnegie	74	136
Fredrick	40	129
Waurika	2	14
Hollis	2	4
Mangum	1	1

Cordell	0	0
Totals:	119	228

Average image per case:	1.9
Average images per day:	10.0
Average cases per day:	5.2

January, 1998

Hospital:	Cases:	Images:
Carnegie	72	152
Fredrick	64	129
Waurika	0	0
Hollis	0	0
Mangum	1	1
Cordell	1	2
Totals:	138	284

Average image per case:	2.1
Average images per day:	13.0
Average cases per day:	6.3