

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

Evaluation of the
Telecommunications and Information Infrastructure Assistance Program

Case Study Report

**Northern New Mexico Rural Telemedicine Project
960066**

Espanola, New Mexico

Site Visitor: Gary Silverstein

Dates of Visit: May 13, 1999

PREFACE

The following case study report is being issued as part of TIIAP's ongoing evaluation initiatives designed to learn about the effects of TIIAP funded projects. This report is one in a series of twelve based on in-depth case studies conducted in 1999 to study three subjects: (1) issues particular to rural communities (2) issues particular to urban communities, and (3) challenges in sustaining information technology-based projects. The case study reports give us evidence about the special challenges that each project faced and provide information for a better understanding of factors that can facilitate the success of such projects.

In addition to being urban or rural, the case study projects were selected because they involved distressed communities, represented innovative models for services, and affected measurable community outcomes. The case studies, conducted under contract by Westat, an independent research firm, consisted of extensive review of project files and records, interviews with project staff, representatives of partner organizations, and project end users. In addition to the 12 individual reports, a summary of findings across the projects is also available on the NTIA website.

NTIA wishes to thank the case study participants for their time and their willingness to share not only successes but also difficulties. Most of all, we applaud your pioneering efforts to bring the benefits of advanced telecommunications and information technologies to communities in need. We are excited about the case studies and the lessons they contain. We believe that these projects provide a unique insight into the variety of ways to eliminate "the digital divide" which exists in our nation. It is through the dissemination of these lessons that we can extend the dividends of TIIAP funded projects nationwide.

We hope you find this case study report valuable. You may obtain other case study reports, a summary of findings of the collected case studies, and other TIIAP publications through the NTIA website (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, or other reports, or suggestions on how TIIAP can better provide information on the results and lesson of its grants, please contact Francine E. Jefferson, Ph.D., at (202) 482-2048 or by email at fjefferson@ntia.doc.gov.

Stephen J. Downs, Director
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Project Name	Northern New Mexico Rural Telemedicine Project
City/State	Espanola, New Mexico
Grant Recipient	Northern New Mexico Community College
OEAM Number	96006
Application Area	Health
TIIAP Grant Amount	\$500,000
Match Amount	\$511,000
Date of Site Visit	May 13, 1999
Site Visitor	Gary Silverstein
Abstract	<p>The project was designed to overcome the barriers associated with the remote locations of the region's clinics and hospitals by using "virtual patient records" to electronically link 17 rural clinics and two hospitals in northern New Mexico. This record-sharing system builds upon a prototype telemedicine system—called TeleMed—that had been developed by staff at the Los Alamos National Laboratory. The system enables physicians to transmit patient information over a World Wide Web interface using Internet gateways or telephone lines. The TIIAP project was only designed to test the online sharing of patient immunization data. In future years, it is anticipated that physicians in northern New Mexico will use the TeleMed system to transmit a wider range of medical data about their patients.</p> <p>At the time of the site visit, the TeleMed application was not actually being used in any of the clinic sites due to a series of delays associated with getting the necessary infrastructure in place. Plans were underway to use the TeleMed software to share information across the three clinics that compose the Las Clinicas del Norte health care system. A test of this plan, scheduled to occur during the spring of 1999, will be limited to the sharing of immunization data. Once this function has been tested, staff at Las Clinicas del Norte would like to place all of their medical records online and take full advantage of the TeleMed system.</p>

A. Background

Community Characteristics

The Northern New Mexico Rural Telemedicine Project is being conducted in the following counties in northern New Mexico: Colfax, Guadalupe, Harding, Los Alamos, Mora, Rio Arriba, San Miguel, Santa Fe, and Taos. The combined population of these nine counties is 222,601 (1990 census). The population density for this region is 27.4 persons per square mile. However, the population density drops to 4.2 persons per square mile when the cities of Los Alamos and Santa Fe are excluded. According to the 1990 Census, 59.6 percent of the residents in these nine counties are Hispanic, 35.9 percent are white (non-Hispanic), and 3.2 percent are Native American (15.2 percent of the residents in Rio Arriba County are Native American).

Approximately one-fifth of families in the project's service area—and one-third of families in two of the nine counties—are living below the poverty level. The service area has no public transit system, a limited manufacturing base, and a small private land base from which to develop an economy. According to a document developed by the Northern New Mexico Community College, 54 percent of the land in Rio Arriba and Taos Counties is owned by the state or federal government, while 17 percent is owned by eight Northern Native American Pueblo Tribes. This leaves these two counties with only 28 percent of their land base from which to develop an economy and generate tax revenues for services. As such, employment opportunities in the region can be scarce. For example, a Walmart that opened in January 1999 received 2,500 applications for 450 positions. One-third of these hires were part-time employees with no benefits.

Project Overview

Problems/Disparities the Project Was Designed to Address. The project was designed to help rural health providers and patients overcome the barriers associated with the remote locations of the region's clinics and hospitals. These barriers include the significant distances that many patients must travel to receive medical care, the distance between rural clinics and larger hospitals that have specialized staff and equipment (in six of the nine counties, clinics are located 30 to 40 miles from the nearest hospital or major medical center), the inability of patients to confer with specialists at remote sites, the lack of a systematic method for sharing medical records across clinics and hospitals, medical providers' limited capital for infrastructure improvements, the difficulty of providing continuing professional development to rural health care

professionals, and the fear that rural practitioners will choose to relocate to urban facilities that offer access to the most recent medical technologies. The project intent was to ameliorate some of these barriers by enhancing medical providers' capacity to access and share patient information. As described in the project's application to TIIAP:

The greatest obstacle to increased efficiency and higher quality of care in NNM (Northern New Mexico) is information management. Most clinics have multiple patient records for the same patient (patient gives different name, social security number, etc.) and are unable to share medical history, prescription, immunization, allergy, and referral records with other health care providers. The resulting information gaps contribute to decreased quality of care, repeated treatments for the same problem from different clinics, unnecessary immunizations, and abuse of controlled substance prescriptions. In addition to these patient problems, health care providers at rural clinics are isolated from their professional peers and often have a difficult time obtaining continuing education.

One of the primary objectives of the Northern New Mexico Rural Telemedicine Project was to facilitate communication among clinics that share common patients. During the site visit, project staff provided examples of instances in which patients might rely on several clinics to receive treatment, including:

- Patients in isolated regions may need to visit another medical provider (e.g., a hospital in Espanola or Los Alamos) for specialized tests or treatments.
- An individual seeking confidential consultation or treatment (e.g., when obtaining birth control advice, taking a pregnancy test, being tested or treated for a sexually transmitted disease, being counseled for substance abuse problems) may travel to a clinic or hospital in another town—especially if the receptionist in the local clinic is on a first-name basis with the patient's immediate family or friends.
- Patients may travel to several clinics in a region to obtain and abuse multiple orders of prescription medications.
- Patients may have to travel to a neighboring medical facility if the nearest clinic is closed (some rural clinics are not open 5 days per week).
- A patient's preferred medical provider may be at a different clinic on a given day.
- Patients may travel to another clinic to obtain a second opinion.

In each of these cases, a patient's failure to bring his/her medical records could potentially result in treatment that is incomplete, duplicative, or harmful.

Technical Approach. The Northern New Mexico Rural Telemedicine Project was designed to overcome these barriers by using a "virtual patient record" to electronically link 17 rural clinics and two hospitals in northern New Mexico. This record-sharing system builds upon a prototype telemedicine system—called TeleMed—that was developed by staff at the Los Alamos National Laboratory (LANL). TeleMed enables physicians to transmit patient information over a World Wide Web interface using Internet gateways or telephone lines. Thus, a physician in a remote clinic could use the system to connect (via the Internet) to a hospital 40 miles away to determine (1) whether a patient had been treated for a given problem, (2) any treatments that had been recommended by other medical providers, and (3) the types of medications that had been prescribed for the patient. Unlike paper-based systems, in which data are copied to multiple locations and then edited and annotated locally, the virtual patient record is designed to enable multiple health care providers to update each record as needed from remote locations—with all appropriate providers having immediate access to the updated records as soon as revised information has been entered.

At the time of the original proposal to TIIAP, an early prototype of the TeleMed system had been deployed at the National Jewish Center for Immunization and Respiratory Disease in Denver. The purpose was to test whether physicians could use the system to treat patients with multi-drug resistant tuberculosis and other lung diseases. In addition, plans were underway for the National Institutes of Health to determine whether TeleMed could be used to enable providers in different sites to discuss the same patient over the Internet.

The New Mexico project provided LANL staff an opportunity to test the feasibility of using TeleMed in a geographically isolated setting. It also enabled LANL staff to "allow further evolution of the system to meet a variety of user needs, and provide further validation of a prototype for a national patient record system." In the words of the LANL individual responsible for overseeing development of TeleMed, "We had developed a Ferrari and needed a road to test it on."

Although TeleMed enables health providers to share a considerable amount of patient data, project staff decided early on that the TIIAP-funded pilot would only be used to share immunization records and patient encounter information (e.g., medications dispensed during

a given clinic visit). The benefits of using TeleMed to facilitate the transmission of immunization data were outlined in program documentation:

Since timely immunizations in the first two years of life are important prognostic indicators for a healthy adult, the electronic medical record provides the means for each provider to quickly determine immunizations that are appropriate for a youngster at the time of their visit, no matter what clinic they visit. Patients who are referred to regional hospitals for procedures, lab tests, diagnostic examinations, will be assisted by having their medical record available to hospital personnel at the time of their arrival, without the time consuming use of numerous phone calls and fax transmissions.

The system will eventually be able to assist physicians by automatically tracking a child's immunization status. As children visit a participating clinic, health care providers would be alerted that a particular vaccine is either due or overdue. This, in turn, would assure that immunizations are administered in a timely manner.

Project staff indicated that limiting the pilot phase to the sharing of immunization data would provide an opportunity for the clinics to start small with a simple application that was guaranteed to work. The plan was to then use the newly installed infrastructure to establish a successful base upon which applications could be added. In addition, project staff believed that medical providers would be relatively comfortable sharing immunization data across clinic sites (it was also believed—and subsequently proven during a series of focus group sessions—that medical providers would initially resist any telemedicine system that was designed to share more personal medical data). According to program documentation:

Starting simple with immunization records, prescriptions and referrals is probably optimal for starting the projects. Small changes have great potential for improving the current system. There are several reasons for initially sharing only a few elements of the patient record. First, it allows people to become familiar with the level of security offered, such that they will be willing to add more information in the future; second, it allows them to simply get used to such a system; third, it is much quicker to learn than a record with many components. It is substantially easier to grow from a small base than to shrink back to a simpler version if too much is incorporated in the initial release.

Anticipated Outcomes. The proposal to TIIAP delineated three primary outcomes: (1) a decrease in the number of instances where patients arrive without referral information, (2) a

decrease in the number of patient records that are lost, and (3) a decrease in the number of patients with multiple—and conflicting—medical records. During the site visit, project staff articulated a number of other potential outcomes:

- A reduction in the number of duplicate prescriptions.
- A reduction in the number of instances in which patients experience an adverse reaction to a drug that was prescribed (these reactions are more likely to occur if physicians lack accurate information on other medications that patients are already taking).
- Increased patient satisfaction, e.g., resulting from a reduction in duplicate tests being performed by multiple medical providers.
- The ability to retain medical staff in isolated rural areas. Specifically, project staff felt that rural physicians concerned about a lack of career opportunities would be eager to participate in a project that was on the cutting edge of medical technology.
- The ability to increase the community college's capacity to prepare students for careers in technical fields. In addition, staff at LANL viewed the project as an opportunity to identify students who might someday work at the lab.
- An increase in the time that physicians and other medical staff would be able to devote to face-to-face contact with clients.
- An increase in the spirit of cooperation among the region's medical providers. According to one respondent, "the very act of sharing information serves to encourage collaborative partnerships."
- The development of powerful and enduring partnerships among the region's medical providers. Several respondents indicated that one of their primary goals was to build partnerships with other organizations in the region that could potentially facilitate their patients' access to quality health care.
- The institutionalization of a mechanism by which individual patient information could be aggregated to a higher level to satisfy institutional, state, and federal reporting mechanisms.

Project Status at the Time of the Site Visit

At the time of the site visit, the project was operating under an extension from TIIAP through September 1999. Because of extensive delays associated with getting individual clinics

connected to the information infrastructure (see Section D), the TeleMed application was not actually being used in any of the clinic sites. Plans were underway to use the TeleMed software to share information across the three clinics that compose the Las Clinicas del Norte health care system. This test, scheduled to occur during the summer of 1999, will be limited to the sharing of immunization data. Once this function has been tested, staff at Las Clinicas del Norte would like to place all of their medical records on line and take full advantage of the TeleMed system.

Project staff were unsure as to whether the other medical providers would deploy the TeleMed system before the TIIAP grant has expired. At the time of the site visit, a number of the clinics affiliated with the Health Centers of Northern New Mexico had yet to be wired (and were therefore not in a position to share data outside of their building). As is discussed later, the high costs associated with connecting rural sites to the Internet may preclude some of these 14 clinics from ever deploying the TeleMed system. In addition, while the two participating hospitals were in a position to use the system to share data internally (e.g., between the emergency room and an onsite pharmacy), they will likely wait until after the immunization function has been tested by Las Clinicas del Norte.

Even after the system has been successfully deployed, a series of confidentiality policies need to be adopted before patient data can be electronically transmitted between two unaffiliated medical providers. (Clinics that operate under the same provider system, such as Las Clinicas del Norte, would be able to share electronic files since they operate under the same confidentiality policies and procedures.)

B. Community Involvement

Characteristics of the Grant Recipient Organization

The project is being administered by the Northern New Mexico Community College in Espanola. The college was founded in 1909 as the Spanish American Normal School in El Rito to train the region's Spanish speakers to become teachers. In 1977, Northern became the state's first designated community college, with funding from the State Legislature and grants. The college, which has 45 full-time and approximately 160 part-time faculty, offers associate's and certificate programs in a range of disciplines. The college has an open door admissions policy—with a high school diploma or GED certificate being the only requirements for admission. Almost three-quarters (72.6 percent) of the student population are Hispanic and 61 percent are female.

The median age of the student population is 31 years. Eighty percent of the students are first-generation college, 75 percent require academic remediation, and 85 percent receive federal financial assistance. In 1998, the community college's two campuses served 2,400 students.

The college's primary mission is to prepare the residents of northern New Mexico for employment. In addition, the college supports a variety of community outreach projects throughout the northern region of the state. According to the 1998 President's Report, the college received \$3.8 million in grant funding in 1997-98 from a variety of sources, including the U.S. Department of Housing and Urban Development, Los Alamos National Laboratory Foundation, Health Careers Opportunity Program, Frost Foundation, and United Way.

The college's primary role on the project was to oversee all aspects of the grant. This has included assuring that the schedule and budget are being met, facilitating communication among the projects' various partners and stakeholders, preparing proposals for additional funding, working with Internet service providers and telephone companies to establish a telecommunications infrastructure, and attending conferences to learn about related activities and to publicize the telemedicine project. The college has also been responsible for obtaining and providing technical assistance to individual sites (as is discussed later, the grant recipient's role in providing technical assistance has diminished since the project's funding for a college-based network administrator expired). Examples of technical assistance that have been provided to individual sites include ordering equipment, deploying and configuring computers and printers, establishing e-mail accounts, and providing training to clinic staff.

Partnerships

The project was developed with the involvement and support of the Los Alamos National Laboratory, several health providers in northern New Mexico, and a variety of public agencies and private companies. Throughout the life of the project, partners and supporters have met on a monthly basis. All of the individuals interviewed during the site visit indicated that one of the primary benefits of the TIIAP grant has been the many relationships that have been forged, e.g., among medical providers, between the LANL and the clinic partners. The general consensus among key stakeholders was that these partnerships would endure well beyond the end of the TIIAP grant. The contributions of the project's predominate partners are summarized below.

Los Alamos National Laboratory. The LANL developed TeleMed, the telemedicine application that was to be tested in the rural clinics and hospitals (TIIAP funding was used to deploy but not to develop the TeleMed system). By participating in the TIIAP project, LANL staff hoped to ascertain whether their telemedicine approach could be successfully implemented in a rural environment.¹ LANL staff articulated a number of other reasons why they enthusiastically supported the project, including the opportunity to learn about the types of telemedicine barriers (e.g., legal, policy, technical, infrastructure) they could expect to encounter in other settings, a desire to return something tangible to the surrounding communities,² and a desire to improve the community college's capacity to serve as a "feeder school" for the LANL—which was (and is) in need of computer specialists.

Medical Providers. A number of medical providers, representing two hospitals and 17 health care clinics, participated in the project. Project staff indicated that in addition to serving as health care facilities, these clinics often serve as a community's library, youth center, senior center, community center, rape education center, and bike helmet distribution center.

Each participating clinic site was required to commit \$25,000 to \$50,000 to the project. In return, clinics hoped to gain access to the Internet, increase their capacity to manage their medical records, and facilitate the sharing of client data with other providers. At the time of the site visit, all of the medical providers had received equipment (e.g., computers, printers) through the TIIAP project, but none of the clinic sites had implemented the TeleMed system. As discussed previously, project staff indicated that the three clinic sites affiliated with Las Clinicas del Norte were preparing to test the system among themselves. Project staff also anticipated that the remaining sites would have the infrastructure in place to begin using TeleMed by the end of 1999.

Other Partners. The project also benefited from the participation of several other partners and supporters. Resources contributed by partners included equipment (e.g., Intel donated 12 computers), office space, equipment, facilities, expertise (e.g., an assessment of the infrastructure needs of participating clinic sites), and data access.

¹As discussed previously, the telemedicine software was already being tested in several optimal environments. LANL staff wanted to use the TIIAP project to assess the feasibility of using TeleMed in a more difficult setting.

²According to a site visit report prepared by Shari Wyatt in March 1997, LANL staff had indicated that "for many years, the Los Alamos Lab was viewed as the 'organization on the hill that makes bombs and does nothing for the community.' They stated they wanted to give back to the communities."

Involving Community Stakeholders

Monthly Meetings. One of the project's most important and enduring achievements is the process used to involve stakeholders and end users in the decision-making process. From the outset, monthly meetings have been used to assure that partners and end users were in general agreement on such key issues as (1) the intermediate and long-term goals and objectives the project would be designed to achieve, (2) the specific TeleMed functions that would (and would not) be deployed during the initial testing phase, (3) the security issues that would have to be resolved before patient records could be shared electronically, (4) the process for educating end users about the purpose and use of both the Internet and the TeleMed system, and (5) the purpose and scope of the project's evaluation activities.

The need to forge a consensus among the project's stakeholders was especially critical, given two interrelated factors. First, LANL had not previously worked with any of the project's other stakeholders. As a result, there was a need to overcome cultural differences between LANL staff (who had access to some of the nation's most advanced technologies) and the region's rural medical providers (many of whom did not even have access to a personal computer). Second, LANL and the prospective end users (i.e., clinical sites, hospitals) had inherently different reasons for wanting the project to succeed. LANL staff primarily wanted to demonstrate the universal feasibility of using TeleMed to provide remote physicians with timely access to critical medical information. Staff from the hospitals and clinics wanted to enhance their access to the information infrastructure and their capacity to share basic information among the region's medical providers. In some of the other sites visited as part of this study, such differing stakeholder needs have hindered projects' efforts to identify common ground and accomplish a shared set of goals. In the New Mexico project, the use of regular face-to-face meetings engendered a shared vision of what the project could realistically achieve in the near and long term.

Project staff credited the use of regular monthly meetings with keeping the partnership strong, focused, and united. These meetings, scheduled for the same day of each month, were generally attended by 15-25 people. It was anticipated that the project's stakeholders would continue to meet on a regular basis long after the TIIAP grant period had ended.

Focus Groups. In addition to the monthly meetings, the project used a series of focus groups to solicit input from prospective end users. Two separate sessions were conducted,

one with receptionists and other staff responsible for medical record keeping, the other with physicians, physician-assistants, and nurse practitioners. A primary purpose of these focus groups was to ascertain (1) what constituted the end users' definition of project success, (2) the current procedures used for medical record keeping, and (3) features that end users would want to see in an online patient record-keeping system.

The focus groups proved to be a useful forum for explaining the purpose of the project and obtaining feedback from the intended beneficiaries. During the sessions, participants expressed a variety of concerns related to security and patient confidentiality, the accuracy and reliability of data generated by the system, and the need to assure that the electronic sharing of data did not provide any of the medical providers a new "competitive edge." Participants also expressed concern that having to use an electronic system to review medical histories would alter the patient-physician relationship. According to a summary of the focus group sessions:

Health care providers are comfortable with paper when they begin a patient encounter. It enables them to look over the patient record while the patient is talking. It takes time to talk with a patient to learn about their health needs. An aging population talks more slowly and the process can't be hurried. Many providers are unwilling to use even a dictating machine, preferring to write their notes by hand. Concerns were expressed as to how they will interact with an electronic system.

Project Outreach

The project used several methods to inform prospective end users about the TeleMed system. Staff from the clinics and hospitals were active participants in the design and development of the project. These staff eventually took a lead role in promoting the benefits of the TeleMed system to their colleagues. In addition, as described previously, a series of focus groups were conducted at the beginning of the project. These focus groups were used to provide background information about the project and solicit end users' input as to the types of functions they would like the system to perform.

As the project progressed, end users received training in how to use their new personal computers to access the Internet. Project staff hoped that providing physicians with Internet access (e.g., for conducting online medical research, communicating electronically with colleagues) would enhance their understanding of TeleMed's potential and, ultimately, foster their buy-in for the project. However, buy-in among end users became a problem as the project

progressed. Project staff indicated that this was due to two factors. First, physicians were not particularly excited about the limited functions (e.g., patient immunization history) that were to be deployed during the project's test phase. Second, project staff indicated that their early assurances about the system were diluted by the subsequent delays in providing Internet access and implementing TeleMed at the clinical sites. After a while, the ongoing delays led physicians to question whether the system would ever be deployed. In hindsight, project staff indicated that the bulk of their outreach efforts should have been postponed until after the infrastructure was in place and the system was ready to be shared with end users.

Training

Staff at the community college were responsible for developing training manuals and providing system-related instruction to the end users. The initial training, conducted with clerical staff after the personal computers were installed at the clinic sites, was held at the community college over several weekends. These sessions were designed to introduce end users to the Internet, e-mail, Netscape, word processing, Access, and Excel. According to project staff, some trainees required instruction in such basic skills as using keyboards, while others were already experienced Internet users (as is discussed in Section C, a needs assessment was used to identify the skill levels and training needs of prospective end users).

By the time of the site visit, the individuals who had been conducting training and providing system support had left the community college. In the short term, this has not presented a problem since the clinic sites have staff on site who can address immediate training needs. However, once TeleMed is deployed, physicians and clerical staff will require additional training in how to access and use the system. LANL staff indicated that they expect to assume responsibility for providing TeleMed training. Once the system is ready, LANL staff hope to train a pool of end users who, in turn, will tutor their colleagues.

Protecting Privacy

The TeleMed system is designed to provide physicians with a secure method of sharing personal and medical information with other providers. Project staff pointed out that TeleMed represents a substantial improvement over current methods used to share patient data (in the words of one respondent, "how do you fax a 50-100 page document?"). For example, when

faxing medical data, there is always a concern that (1) sensitive information will be intercepted by staff who are not authorized to view patient medical records, (2) a misdialed phone number will result in sensitive information being faxed to a private residence, and (3) the length of the document to be faxed will result in lost pages and incomplete information being passed on to a physician.

The TeleMed system overcomes these problems by assuring (1) authentication, i.e., users are who they say they are, (2) authorization, i.e., users are allowed to do what they ask to do, and (3) confidentiality, i.e., the requested data are given only to authenticated, authorized users. In addition, in an effort to ease providers' fears about system integrity, the initial deployment of TeleMed will only involve the electronic transfer of immunization data (which are not considered to pose a security or liability threat). Project staff suggested that successful deployment of the immunization module would alleviate providers' concerns about the use of the Internet to transmit medical data.

During the initial focus group sessions, clerical staff and medical practitioners raised a number of concerns about using the Internet to transmit patient data. For example, participants expressed concern about who would have access to the medical records and how access would be controlled, with some suggesting that patients should have some (or total) control over who has access to their medical history.

At the time of the site visit, project staff were struggling to develop a process by which patients could grant permission to have their medical data shared electronically with other providers. Several barriers were cited as complicating this task. First, project staff underestimated the amount of time required to develop a patient consent form that would satisfy the concerns of multiple stakeholders. This happened, in part, because staff were planning to modify forms being used to obtain patient consent in another Internet-based system. However, as it turned out, these forms were being used to approve data transfers within a single medical provider system—and therefore did not address issues associated with sharing data *across* two or more medical provider systems.³

Second, participating clinics need to delineate the specific items in a virtual patient record that a given individual should be able to access. For example, clerical staff might be

³ As discussed previously, project staff distinguish between data sharing among affiliated medical providers (e.g., two clinics in the Las Clinicas del Norte system, an emergency room and a pharmacy in a single hospital) and transactions that occur between unaffiliated medical providers (e.g., a hospital and a rural clinic).

permitted to access a patient's address and billing information, a nurse might be able to access a patient's medication schedule, and a physician might be able to access all data within a patient's medical record. These "rules" can then be incorporated into the TeleMed system; e.g., an end user's identification code would automatically enable or restrict access to a given data item. This process becomes complicated when providers have different rules regarding levels of access; e.g., in clinic A, nurses are only permitted to view a patient's medication history, while clinic B permits nurses to access all information within a patient's medical record. These differences will need to be resolved and incorporated into the TeleMed system before any patient data can be shared electronically across distinct medical provider systems.

Project staff indicated that the remaining issues surrounding confidentiality protocols for electronic patient records would eventually be resolved. In the words of one respondent,

The security issue will be resolved because all of the key stakeholders want this [the electronic transfer of medical records] to happen. However, solving this issue will not become a high priority until the infrastructure is in place. We can only handle one priority at a time.

C. Evaluation and Dissemination

Evaluation

The project has invested considerable time and effort in a series of evaluation activities that will ultimately provide stakeholders with valuable information about TeleMed's impact on end users and other beneficiaries. A considerable amount of baseline data have already been collected. As each component of the system is deployed, project staff intend to collect follow-up data that can be used to assess TeleMed's impact on staff workflow and patients' well-being (much of this information will be collected after the TIIAP grant has expired). One driving force for implementing the full evaluation is LANL's desire to demonstrate the impact that TeleMed can have on patient care in a rural setting.

The evaluation includes five separate components: a needs assessment, a series of focus groups, a job task analysis, a time-motion study, and a pre- and post-intervention documentation of immunization records. Each of these activities is discussed below.

Needs Assessment. At the beginning of the project, staff from Information Assets Management, Inc., and LANL conducted a series of site visits to the participating clinics and hospitals. The purpose was to acquaint the project team with technology status, daily operations, and overall needs of the medical providers that would be piloting the TeleMed system. The needs assessment was also used to document each site's existing (1) PC computing capability, (2) power quality, (3) telephone quality and Internet connectivity, (4) office space capacity to house a TeleMed server, and (5) staff level of expertise and experience in using computers and the Internet.

The needs assessment found that clinic staff generally operated in small and crowded conditions. Although the two hospitals were well equipped with computer technology, the majority of clinics lacked PCs (or the existing PCs were very old). None of the sites had direct connections to the Internet, although staff expressed considerable interest in gaining Internet access. Sites expressed concern about having to concurrently maintain several different systems for managing patient information. The needs assessment was also used to make a number of recommendations, including (1) provide staff with basic training in how to use computers and related technologies (the mouse and keyboard, the Internet, and e-mail), (2) install a dedicated line for Internet access in the clinics to facilitate ongoing Internet use (and allow rapid and reliable sharing of patient data), (3) equip all servers with backup units, and (4) provide all servers with virus protection software.

Focus Groups. As discussed previously, a series of pre- and post-intervention focus groups are being convened to obtain end users' views on the impact and effectiveness of the TeleMed system. The pre-intervention sessions were also used to ascertain (1) what constituted the end users' definition of project success, (2) the current procedures used for medical record keeping, and (3) features that end users would want to see in an online patient record-keeping system.

Job Task Analysis. Following the focus groups, staff from LANL conducted a job task analysis to identify specific activities and functions that TeleMed might eventually be able to facilitate. This activity—which will be repeated after the TeleMed system has been implemented—also collected baseline data that will eventually be used to ascertain whether and how TeleMed affected the range of functions routinely performed by the project's intended end users.

Project staff used a second round of focus groups to (1) develop an inventory of the broad functions that end users perform on a regular basis, (2) identify the specific tasks required to perform a given function, (3) document how often a given task is performed,⁴ and (4) document the average time required to complete a given task.⁵ Findings from these sessions were then used to develop two survey instruments—for medical record keepers and health care providers—that could quantify focus group findings across a greater number of end users. The surveys also obtained data on respondents' demographic characteristics, the difficulty of performing a given task,⁶ the relative consequences of performing a given task in an improper or untimely manner, and the extent to which specific tasks were being performed in as an effective manner as possible.

A total of 129 surveys were distributed to 43 medical record keepers and 86 health care providers (the overall response rate was 26.7 percent). The study found that health care providers were most likely to need an online system that facilitated their access to medical information, while medical record keepers were most likely to need facilitated access to patients' personal data (e.g., birth date, address, insurance and billing records). This led the study's author⁷ to conclude that:

If the primary focus of the TeleMed system is to be on storing and sharing *medical* information (such as immunization records or other health history information) rather than other personal information about patients (such as address, date of birth, insurance information, etc.), it is the providers who will be the primary beneficiaries of the system. The system's designers should be mindful of this distinction, with weight being placed on providers' expressed wants and needs as design progresses. Second, but perhaps more important is the observation that within the medical records keepers' task list, there is a large number of administrative activities that do not require much, if any, contact with *medical* information... This suggests that, to the extent that medical record keepers are to be considered in TeleMed's design, system features that handle administrative data and tracking should be considered.

⁴ Options included (1) never, (2) less than once a year, (3) once every 3 to 12 months, (4) once every 8 days to 3 months, (5) once every 2 to 7 days, and (6) at least daily.

⁵ Options included (1) less than 15 minutes, (2) 15 minutes up to 1 hour, (3) 1 hour to 4 hours, (4) 4 hours up to 8 hours, (5) more than 1 day.

⁶ Options included (1) very easy—low mental activity and low degree of task complexity, (2) somewhat easy—low mental activity and medium degree of task complexity, (3) moderately difficult—medium mental activity and medium degree of task complexity, (4) very difficult—medium to high mental activity and high degree of task complexity, and (5) extremely difficult—medium to high mental activity and very high degree of task complexity.

⁷ Heidi Ann Hahn, *Job Task Analysis for the Northern New Mexico Rural Telemedicine Project*. Human Factors Group, Technology and Safety Assessment Division, Los Alamos National Laboratory, 1997.

The study also found that, once fully implemented, the TeleMed system had tremendous potential for improving the health care providers' job experiences by increasing the speed and accuracy of task performance (since a high percentage of their tasks were identified as being cumbersome, time consuming, and error prone). However, given the nature of tasks performed by record keepers, the study's author concluded that:

Gaps experienced by the medical record keepers primarily involved tasks which are performed frequently, but not viewed as particularly satisfactory. While focusing on these tasks as candidates for electronic augmentation might have a positive effect on the attitudes of incumbents, it is not likely to result in productivity gains at the task level. Thus, this analysis supports the assertion made previously that the providers be considered as the primary audience for TeleMed, and that the providers' results receive greater weight in making decisions about what electronic features to implement.

Once TeleMed has been implemented, a follow-up job task analysis will be conducted to assess the extent to which the system has affected the range of tasks performed by health care providers and medical record keepers. Four types of analyses will be conducted:

1. A pre-post comparison to assess differences in the experience levels of respondents. The purpose will be to ensure that "any results attributed to TeleMed have actually been caused by system implementation rather than through systematic variations in the subject population."
2. A crosswalk of the pre-post task lists to determine the degree of overlap between the pre-TeleMed and post-TeleMed activities. The purpose will be to assess whether the nature of the work performed by a given staff type changed after TeleMed was implemented.
3. A pre-post comparison of the ratings assigned to specific tasks and sub-tasks performed by a given staff type. The purpose will be to assess whether TeleMed precipitated any changes in how tasks are performed and perceived. For example, is a given task performed more or less frequently? Does the task require more or less time to complete? Has it become easier to complete the task?
4. A pre-post analysis of whether specific tasks were being performed in as an effective manner as possible.

Time-Motion Studies. In addition to performing a job task analysis, LANL staff conducted a series of time-motion studies at three rural clinics and the Los Alamos Medical Center emergency room. The study, which documented the activities and movements of prospective end users, was designed to collect baseline data that could ultimately be used to

assess the impact of TeleMed on staff workflow (the study will be repeated after the TeleMed system has been deployed). At each of the study sites, a research assistant followed an individual worker (e.g., receptionist, record keeper, nurse, medical provider) for 3 continuous hours. The time required to complete each discrete task was timed with a stopwatch, and the subject’s movements were documented on a floor plan of the site. Over a period of several weeks, this process was used to accumulate 62 hours of observations.

As shown in Exhibit 1, the baseline study found that health care providers were spending 41 percent of their time with patients, while medical record keepers were devoting the vast majority of their time to clinical operations. (The study also found that 74 percent of the time that record keepers spent on clinical operations was actually devoted to billing activities.) Once TeleMed has been fully implemented, a follow-up time-motion study will be used to assess whether (1) health care providers are spending more time with their patients, and (2) record keepers are spending less time on patient interactions (the objective is that less time will eventually be required to “associate a given patient with their medical record”).

Exhibit 1: Results of the Baseline Time-Motion Study

Staff type	Functions ⁸					
	Patient interactions	Medical records	Personnel interactions	Pharmacy duties	Clinical operations	Continuing education
Medical record keepers	11.8%	7.7%	5.0%	0.0%	75.5%	0.0%
Health care providers	40.6%	19.0%	14.6%	6.1%	14.5%	5.2%

Documentation of Immunization Records. As discussed previously, the initial deployment of the TeleMed system will focus on the electronic transmission of patient immunization data. To assess whether the system precipitates an increase in timely vaccinations, project staff intend to collect pre- and post-deployment data on immunization rates among children. Using the Clinical Assessment Software Application (a software program created by the National Immunization Program of the Centers for Disease Control and Prevention), project staff compiled baseline immunization data on children between the ages of 0 and 2. These data,

⁸ *Patient interactions* refer to phone calls and patient encounters. *Medical record interactions* refer to pulling or filing charts, reviewing records, recording chart entries/dictations/lab results, making copies, and faxing records. *Clinical operations* refer to preparing exam rooms, running lab tests, preparing/ordering/obtaining supplies, making/responding to phone calls, and paperwork and billing activities.

collected in May 1997, showed that 221 children between 0 and 2 years had visited the clinics during the previous 2 years. Of this number, 39 percent had been vaccinated for diphtheria, tetanus, and pertussis; 55 percent had been vaccinated for polio; 46 percent had been vaccinated for measles, mumps, and rubella; 56 percent had been vaccinated for haemophilus influenza type B; and 49 percent had been vaccinated for hepatitis B. (The baseline study notes that these figures reflect only the percentage of children who were immunized at the participating clinics. These figures do not account for children who were immunized elsewhere, e.g., at school or a public health office. In addition, at the time these baseline data were collected, the influenza and hepatitis vaccines were recommended, but not required, for 2-year-old children.) Once the immunization component of the TeleMed system has been deployed for an extended period of time, project staff will collect follow-up data to assess whether clinics are administering these vaccines to a higher percentage of their target population.

Dissemination

The project has used a variety of strategies to disseminate information about both the TeleMed system and the range of activities supported by the TIIAP grant. LANL staff have published several journal articles about the purpose and design of the TeleMed system. The director and other project staff have also presented information about the project at a number of regional and national conferences. A considerable amount of information about TeleMed and the New Mexico TIIAP project has been made available on LANL and project-specific web sites. Finally, project staff indicated that they frequently receive e-mail and phone queries about the TIIAP initiative.

D. Problems Encountered

The Northern New Mexico Rural Telemedicine Project experienced a number of problems that delayed the deployment of the TeleMed system. At the time of the site visit, it was unclear whether these problems would ultimately affect the project's ability to achieve all of the objectives delineated in the original proposal to TIIAP.

Difficulty Obtaining Matching Funds

At the beginning of the project, a number of partners—including several telephone companies—withdrawed their support for the project. According to project staff, technical specialists in one corporation were prepared to lend substantial financial support (\$250,000) to what they envisioned would be a “global physician network.” However, this support was ultimately terminated when corporate staff decided that there was no long-term cash benefit to wiring such a rural region, that is, there would not be enough other users outside of the medical community to make the system financially viable. The project’s second quarterly project report to TIIAP (April 1997) summarized the challenges of obtaining long-term matching funds from corporate partners:

The continuing problem with this project has been to maintain a secure match with corporate funders in a rural county with a population of approximately 36,000, a per capita income of approximately \$10,000, 13.7 percent unemployment, and no industry. We have finally been able (with the help of our program officer) to put together a match substantially with the people who always make things work in rural northern New Mexico, the community college, the Los Alamos National Laboratory, the state of New Mexico, and local non-profit agencies.

The quarterly report concludes that one overriding problem with the TIIAP match requirement is that there is “no penalty for corporations...who commit to a large match and then simply pull out of the process leaving the non-profit community partnership holding the bag.”

In the short-term, the loss of corporate support required the project to devote valuable staff resources to identifying alternative funding sources. In the long term, it delayed the hiring of a project director (since the community college lacked the resources to hire additional staff until federal funding for the project had been authorized) and contributed to extensive delays in connecting participating clinics to the information infrastructure. (As is discussed later, project staff concluded that in hindsight, it would have been better if they had received a planning grant. This would have enabled them to (1) solidify their financial base, (2) assess the status of the region’s telecommunications infrastructure, and (3) identify phone companies that were willing to take on the task of connecting the participating clinics and hospitals.)

Delays Due to Difficulties Gaining Line Connections

A second factor that caused a significant delay in the deployment of TeleMed was the lack of a telecommunications infrastructure in northern New Mexico. This problem was compounded by a number of interrelated factors. First, several small, independent telephone companies provided service to the region. As a result, a single health care provider network with many clinic sites might have to negotiate with multiple providers to secure connections for all of its sites. In addition, the lack of a single provider meant that some health care providers had to engage in complicated technical arrangements to gain Internet service. Also, participating clinics risked incurring additional costs associated with providing Internet services across two phone systems (one respondent cited a \$1,000 per month expense to cover a 12-inch gap where the wires for one phone company system ended and another began). Second, phone companies were generally unwilling to provide cost-effective Internet services to a region that was viewed as lacking other potential users (e.g., businesses, households). Third, rates for several of the small, independent phone companies fluctuated over time, leaving participating clinics concerned that their costs might unexpectedly increase in any given month. As a result of this issue, staff at the Health Centers of Northern New Mexico indicated during the site visit that they were reluctant to network their most rural clinics.

Lack of Support by College Administrators

At the time of the site visit, the grant recipient had decided to withdraw from the project at the end of the TIIAP grant period. This decision reflected the belief of top-level administrators at the Northern New Mexico Community College that the role of their institution was to initiate and facilitate—but not sustain—efforts to bring telemedicine to the region's health care providers. Once a process for implementing such a system had been established, the administrators did not believe that the community college should assume ongoing responsibility for the telemedicine initiative.

The project's partners were disappointed—but not surprised—by the community college's decision to discontinue its participation in the telemedicine initiative (several respondents pointed out that the TIIAP proposal had been prepared under the direction of a previous college president). Respondents were equally disappointed that specific segments within the community college were not more supportive of the project *during* the TIIAP grant period. For example, none of the top-level administrators attended the monthly meetings, which were held at the

community college. In addition, none of the faculty or students from the community college's computer science department were asked to participate in the project to provide clinics with training or technical support. Several respondents indicated that they would have expected faculty to be especially interested in being part of an initiative that was on the cutting edge of computer technology. Further, they would have expected the community college to use the project as a means of creating potential learning and employment opportunities for computer science students.

Staff Turnover

By the time of the site visit, most of the individuals who had conceived of and supported the telemedicine project had left the community college (most of these individuals left for higher paying jobs). This included the original college president, who had encouraged the development of the TIIAP proposal, the individual who had prepared the TIIAP proposal, and the two staff who had provided training and technical support to the clinics. Respondents indicated that as the project progressed, the departure of these staff placed additional pressure on LANL to provide clinics with training and technical support.

Delays Due to Developing a Patient Confidentiality Policy

At the time of the site visit, the online capacity to share patient data across unaffiliated health care providers had been delayed until all participating hospitals and clinics could develop common confidentiality policies and procedures. Several barriers were cited as complicating this task, including (1) the amount of time required to develop a patient consent form that would satisfy the concerns of multiple stakeholders, and (2) differing levels of access to confidential patient data across unaffiliated providers (see Section B for a more comprehensive discussion of this issue).

Project staff were confident that once the participating health care providers had developed appropriate procedures, the technology would be sufficient to safeguard patient data. They did note, however, that this issue might need to be revisited each time a new provider was added to the system. Nonetheless, project staff indicated that once they had resolved this issue, the resulting consent forms would be of use to other telemedicine projects that seek to link unaffiliated providers.

E. Project Outcomes

Impact on End Users

As discussed previously, the TeleMed software had not been deployed in any of the clinics at the time of the site visit. It is therefore not possible to describe the system's impact on medical practitioners in northern New Mexico.

Project staff were, however, able to describe the benefits of providing health care providers and record keepers with personal computers and access to the Internet. Prior to the TIIAP project, clinics were not equipped with personal computers. Internal record keeping was done on paper, and communication among clinics was primarily accomplished via long distance telephone conversations. While the clinics received personal computers early in the project, they did not receive modems and access to the Internet until 1998.⁹ Project staff indicated that clinic staff primarily used their personal computers for word processing. Some staff also learned how to use the database support packages. Once they received Internet access, medical providers and clerical staff began making considerable use of e-mail to communicate with colleagues in other sites to avoid the high cost of phone calls between the clinics and between clinics and the nearest hospital. In addition, providers in these clinics have been using the Internet to conduct research and access national medical databases.

Impact on Other Beneficiaries

According to project staff, residents in some isolated communities have begun using the clinics' personal computers to become familiar with the Internet. One respondent pointed out that in much of northern New Mexico, health clinics represented the only workplace where workers had integrated personal computers into their daily routines. Citing the importance of maximizing the clinic's role in the community, he provided numerous examples of how youth (and other residents) have been provided with opportunities to learn about and use computers. (This emphasis on providing computer access to youth was considered especially important, since the local schools are not connected to the Internet.) For example, Las Clinicas del Norte has trained several high school students to purchase computer components on the Internet and build and fix computers. Learning these new skills improved the students' self-esteem and provided them with

⁹ At the time of the site visit, some of the clinics did not have dedicated phone lines for accessing the Internet. As such, they were not able to use the Internet on a regular basis. Project staff indicated that these remaining clinics should have dedicated phone lines, routers, and servers by July 1999.

a highly marketable skill, especially given the shortage of computer specialists in the project's service area.

Project staff also indicated that their collective efforts forced the development of a telecommunications infrastructure in many of the area's more isolated regions. They predicted that this, in turn, would ultimately benefit other businesses and individuals that wanted economical and reliable access to the Internet.

Impact on Grant Recipient and Project Partners

As described previously, one of the project's biggest impacts has been the new partnerships that have been formed between LANL and the region's medical providers (as well as the enhanced relationships among the providers themselves). The long-term importance of these new partnerships cannot be overstated. As a result of the project, LANL staff now have access to practitioners in the field who can "reality test" their ideas and online applications (in the words of one LANL respondent, "we now have the capacity to 'turn fusion into power'"). Conversely, as a result of their ongoing conversations with LANL staff, rural practitioners now have access to some of the best technical expertise in the world. Although they had not previously worked together, it was very evident throughout the site visit that the project's various stakeholders intend to continue meeting on a regular basis beyond the TIIAP grant period.

The project has also changed the way in which health care providers view computers and other emerging technologies. For example, when Las Clinicas del Norte opened its new clinic, the site was equipped with 25 new computers. Although this equipment was not purchased with TIIAP funds, one of the respondents credited the project with having educated the clinic's administrator and staff as to the benefits of using the Internet for research and e-mail communication.

F. Sustainability and Project Expansion

Sustainability

At the time of the site visit, project staff were exploring options for maintaining the project over the long term. The biggest issue facing stakeholders was not *whether* to sustain the

project. Rather, the issue was *how* to maintain the partnership in light of the grant recipient's decision to withdraw from the project at the end of the TIIAP grant period.

The grant recipient's decision places the partnership in a temporary bind. The project director at the community college performed a number of centralized functions that were critical to the ongoing maintenance of the partnership. Given the number of organizations participating in the initiative, project staff indicated that they needed to identify a single entity that would be able to coordinate activities and keep a diverse group of stakeholders focused on a common set of goals. In addition, given the inherently competitive nature of the relationship between health care providers, project staff indicated that this central entity could not be one of the participating clinics or hospitals.

LANL staff indicated that they would be able to serve as project coordinator until a permanent organization could be identified. One such organization, the Rio Arriba Family Care Network (RAFCN),¹⁰ has been approached about taking on the role of project coordinator. RAFCN's decision of whether or not to take on the role of project coordinator will likely hinge on whether or not funding can be obtained to cover the costs of project coordination.

Regardless of who takes on the role of project coordinator, the partnership clearly intends to keep this project alive beyond the TIIAP grant period and the departure of the grant recipient. This can likely be attributed to several factors. First, stakeholders have already made enough progress to justify an additional investment in time and effort. Second, there is still an acute need to facilitate online communication among rural health care providers in northern New Mexico. Finally, LANL staff remain strongly committed to testing TeleMed in their own backyard. LANL staff reiterated that if TeleMed can work in northern New Mexico, it can work anywhere. As such, the upcoming trial run with Las Clinicas del Norte represents an important opportunity to demonstrate the viability of the TeleMed system.

¹⁰The Rio Arriba Family Care Network is a private nonprofit coalition of health care and human service providers in Rio Arriba County. Composed of 27 member agencies, including all of the health care providers that are participating in the telemedicine project, the organization co-produced Rio Arriba's first countywide health care needs assessment. It has also served as an advisory council to the Rio Arriba County Commission on matters pertaining to health and human services, developed a multi-county welfare-to-work model, prepared a countywide substance and alcohol abuse treatment and prevention plan, and developed a financing system to serve the county's uninsured.

Project Expansion

At the time of the site visit, the TeleMed system had not been expanded to serve other communities in New Mexico. Nor had its functions been expanded to serve the additional needs of end users. This is not surprising, given that TeleMed had yet to be deployed in the original project area. Once the system has been deployed, it is likely that an expanded version of TeleMed will be made available to other regions of the state.

Project staff did report that as a result of the TIIAP initiative, they had begun working with the New Mexico Department of Health to develop a statewide immunization information system (SIIS) that would enable health care providers to share immunization data. This online network, which shares many of the features of the TeleMed system, is being considered by a statewide partnership that includes LANL's Advanced Computing Laboratory, managed care and health maintenance organizations, medical and academic centers, professional societies, primary care clinics and providers, public and private health care providers, and other federal and state agencies.

Project staff indicated that developing a statewide immunization network would require a considerable amount of time and effort. In addition, the deployment of an SIIS would involve many of the same barriers (e.g., poor telecommunications infrastructure, need for a single server that could coordinate the exchange of statewide data, need to develop confidentiality policies across participating agencies) encountered by the Northern New Mexico Rural Telemedicine Project. Nonetheless, project staff indicated that the potential exists for the TIIAP initiative to serve as the test bed for a statewide immunization system.

G. Lessons Learned and Recommendations for Other Communities

Project staff identified a series of lessons that they learned as a result of their efforts to introduce telemedicine to health care providers in northern New Mexico. While some of these lessons are specific to telemedicine projects, others pertain to any human service agency that is interested in using "virtual client records" to facilitate information sharing among multiple personnel who interact with—and document the services provided to—a single individual.

Set Aside Sufficient Time to Assess the End User's Telecommunications Infrastructure. Prior to applying for TIIAP funding, project staff indicated that they had a

comprehensive understanding of the *need* that their project was designed to address. However, some of the individuals interviewed during the site visit indicated that, in hindsight, they should have also assessed the *feasibility* of implementing their proposed approach—in the proposed timeframe—in some of the state’s most rural regions. Such a feasibility study could have been used to (1) document the steps that would need to be taken to connect participating clinics and hospitals to the information infrastructure, (2) more fully assess the willingness of the region’s telecommunications providers to extend Internet access to participating health care providers, and (3) identify the full range of barriers that would need to be overcome before the TeleMed system could be deployed. While many of these issues were addressed during the initiative, project staff indicated that it would have been useful to have had this information in hand at the time the TIIAP proposal was submitted.

Project staff therefore recommended that communities attempt to address these issues before submitting a proposal to TIIAP. As an alternative, they suggested that projects include a 6- to 12-month planning phase in their implementation schedule that can be used to align partners’ expectations, work with telephone companies and other providers to assess the telecommunications capabilities of prospective end users, identify a realistic process and timetable for enhancing end users’ telecommunications capabilities, assess whether there are any alternative approaches that might be easier to implement, and collect baseline data that can eventually be used to assess the project’s impact.

Convene Stakeholder Meetings on a Regular Basis. Project staff suggested that a valuable lesson from their planning process is that all relevant partners and stakeholders should begin meeting on a regular basis as early in the process as possible. (In the words of one respondent, “technology is a piece of cake—the hard part is working with people.”) Respondents also noted that by convening at the same time (e.g., the last Friday of every month), participants will be more likely to consider these meetings a permanent fixture on their calendar.

The Northern New Mexico Rural Telemedicine Project demonstrated the value of involving stakeholders and end users in all key decisions. From the beginning, partners and prospective end users were provided ample opportunity—through monthly meetings and focus groups—to describe what they hoped to gain from the telemedicine project. The mechanisms used to solicit stakeholder input served to promote long-term buy-in for the system (especially among project partners). This long-term buy-in to the project’s ultimate “vision” was especially critical, given the extensive delays that hindered the timely deployment of TeleMed. It will be interesting to track the project’s future progress to determine whether the use of monthly meetings and focus

groups ultimately results in a system that meets the needs of the region's health care providers and medical record keepers.

Establish Written Agreements with Partners. Respondents stressed the importance of establishing clear written guidelines with partners. These guidelines, developed at the outset of the planning process, should delineate the roles and responsibilities of all participating entities.

Develop a Project Team That Encompasses the Necessary Range of Skills. The team responsible for developing and implementing the Northern New Mexico Rural Telemedicine Project possessed a good mix of technical and medical knowledge. In addition, through the use of monthly meetings and ongoing evaluation activities (e.g., focus groups, needs assessments), the project team augmented its knowledge of the technical and operational issues that would need to be addressed within and across sites.

Do Not Raise the Expectations of End Users Prematurely. If expectations continually exceed reality, end users will lose faith in the system before it has even been implemented. From the very beginning, physicians and other end users were asked to offer feedback on what the telemedicine project should be designed to accomplish. Unfortunately, delays associated with the clinics' poor telecommunications infrastructure have led some end users to lose interest and faith in the project. According to one respondent, "It will be hard to re-engage the medical providers in the final product. They have already started to bad mouth the project." In hindsight, project staff indicated that they should not have promoted TeleMed to health care providers until they actually had a system that was closer to being operational.

Begin with a Small, Manageable Component of the Overall Project. Project staff stressed the importance of providing partners and end users with a series of small victories along the way to keep participants motivated, focused, and "hopeful." Because the initial deployment of TeleMed is occurring in only three clinics (as opposed to *all* of the participating clinics and hospitals), project staff will have an opportunity to focus their energies on a manageable cluster of end users. The lessons learned from this trial run will enable the project team to make any necessary adjustments before deploying the system to all of the participating clinics and hospitals.

Provide End Users with the Necessary Technical Skills. As the initiative progresses, there is a growing risk that LANL staff will be required to play a greater role in

providing clinics with technical support and training. Given the size of the territory to be covered, project staff recognize that this is not a practical long-term solution. As such, they recommended that future telemedicine initiatives take steps to train a pool of clinic/hospital staff who can serve as trainers and technical trouble shooters.

Include Stakeholders in the Process of Selecting the Project Director. The community college was not in a position to hire a project director until after the TIIAP grant had been awarded. In spite of their role in the rest of the initiative, none of the partners was asked to participate in the process of (1) determining the qualifications for and role of the project director, (2) interviewing prospective candidates, or (3) making the final selection. While partners understood the community college's position—in the words of one respondent, “Who wants to give up that kind of control?”—they also suggested that their input would have helped them feel more vested in their new leader. (It should be noted that the project director expressed similar concerns with the process by which he was selected.)

Several respondents (including the project director) also suggested that future telemedicine initiatives select a director with at least some medical knowledge. They indicated that selecting a project director who is familiar with both computers and the health care industry would facilitate ongoing outreach efforts among medical and technical staff.

The Grant Recipient's Leadership Should be Willing to Energetically Support the Effort During and After the TIIAP Grant. Respondents indicated that the community college's decision to discontinue its support for the project—and the resulting scramble among partners to find new leadership—has slowed the progress they were making in achieving their goals. As a result, one respondent suggested that future telemedicine projects should avoid selecting a “weaner” (an entity that intends to wean clinics after the initial round of funding has expired) as a grant recipient—since it provides a built-in incentive for the grant recipient to lose interest in the initiative during the project's final year.

Respondents also suggested that community colleges may not be suited to serve as grant recipients for telemedicine projects. (They indicated that the exception would be postsecondary institutions that have a strong vision of how the project would (1) serve the surrounding community and (2) complement their mission to provide new opportunities for their faculty and students.) As an alternative, respondents recommended that telemedicine projects require a grant recipient that stands to directly benefit from the proposed approach. However,

they also emphasized that the grant recipient needs to be a neutral party that can bring together competing medical providers.

H. Summary and Conclusions

Although only partially implemented, the Northern New Mexico Rural Telemedicine Project has already had an enormous impact in the rural regions of northern New Mexico. Specifically, it has laid the groundwork for the deployment of a telemedicine network, introduced e-mail and the Internet to a growing number of medical end users, helped to forge a long-term alliance between LANL and the region's health care providers, and served as a model for a potential statewide immunization database.

From a national perspective, the project serves as a model on several fronts. First, it suggests a process for using meetings and focus groups to garner community support and involve partners and end users in the decision-making process. Second, it provides an effective model for collecting data that can be used to evaluate the impact of technology in the workplace. Third, it represents one of the nation's first efforts to develop forms and procedures that can be used to transmit patient data electronically across unaffiliated medical providers.