Using Telehealth to Improve Quality and Safety

Findings from the AHRQ Health IT Portfolio

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Background

What is Telehealth?

Telehealth is the use of telecommunications technologies to deliver health-related services and information that support patient care, administrative activities, and health education. Telehealth is being touted as a means to improve access to care, while reducing costs of transportation and increasing convenience to patients in obtaining care. Access to care is an issue in regions where physician-to-patient ratios are inadequate, or where there are not enough medical specialists available to meet the population's needs. As such, it has become a key component of multifaceted strategies to improve health service delivery in medically underserved areas in both rural and urban settings. When patients are better able to access medical care, they can have acute conditions treated locally, receive treatment for medical problems before they become critical, and receive care to better manage chronic conditions.[1, 2]

In rural areas, health care delivery systems struggle to maintain adequate numbers of clinical staff to serve their patient populations. Medical specialists are in particularly short supply. Although 20 percent of the U.S. population resides in rural areas, only 9 percent of physicians and 10 percent of specialists practice in these areas.[3] Lack of access to medical specialists is not just a rural problem. Many urban areas also do not have enough specialists to provide care in fields such as dermatology and stroke care.[4,5] Studies have shown that telehealth can improve access to specialty care in underserved areas,[6,7,8,9,4] and among underserved populations such as inmates and nursing home residents.[10,11,12,13,14,15]

Telehealth can improve convenience for patients while reducing health care system costs and increasing opportunities for clinicians. It allows patients to seek care closer to home so they do not need to travel long distances to receive consultations.[16,17,18,19] Telehealth can also reduce the amount of time that patients must wait for specialty care.[20,21,22] By allowing a primary care physician to be able to manage a condition via telehealth, visits to specialists can be reduced, reducing travel and transports, and reducing patients' health care utilization.[20,23,24,25,26,27] A recent report from the Center for IT Leadership reported that savings due to reductions in patient transports and face-to-face visits could cover the cost of

implementing telehealth.[28] In addition, these technologies can be used to deliver educational programs for providers, such as continuing medical education and other training opportunities.[29,30] These and other benefits of telehealth can support improved provider productivity.[24,25]

Telehealth applications have been conceived, developed, and deployed in a variety of clinical settings; yet the body of evidence supporting their use has been slow to evolve. Significant questions remain unanswered about the value, efficacy, and effectiveness of these technologies.[31,32,33] In addition to these questions, difficulty in outlining a telehealth business case, concerns regarding privacy and security, reimbursement issues, and a lack of reciprocity in State medical licensing are among the issues that have hampered broad adoption of telehealth across the country. In order to address some of the questions around the value, efficacy, and effectiveness of telehealth and to study barriers to implementation and adoption of these technologies, a number of Federal agencies, including the Agency for Healthcare Research and Quality (AHRQ), and private organizations are currently funding telehealth research.

Scope

Since 2004, AHRQ has awarded over $260 million in funding for health IT. The AHRQ health IT portfolio consists of grants and contracts to support planning, implementation, and evaluation of various information technologies that were intended to improve the quality, safety, and efficiency of health care delivery. This portfolio includes a National Resource Center for Health IT (NRC), which was created to support AHRQ-funded projects in adopting and evaluating health IT. The NRC has established an infrastructure for collecting, analyzing, and disseminating best practices and lessons learned from its portfolio of health IT projects.

This report focuses on grants in AHRQ's health IT portfolio that are focused on implementing or evaluating telehealth in order to improve care for patients, increase efficiency, and contain costs. The analysis presented here provides a snapshot of these funded activities. The scope of this discussion is limited to challenges faced by grantees in developing, implementing, or evaluating telehealth interventions. The report does not

include an evaluation of the projects' final outcomes. AHRQ has encouraged individual grantees to disseminate information about the final results of their work through peer-reviewed journals, trade publications, and other vehicles.

The authors reviewed original grant applications to identify telehealth implementation projects within the AHRQ health IT portfolio. For each project included in this analysis, we contacted the lead investigators to schedule interviews. These interviews became the primary data source for this report. Interview questions were developed in advance and were shared with the lead investigators. This format enabled us to question the investigators about core project design elements, key challenges, lessons learned, and future directions. The stories of these projects are presented below.

Profile of AHRQ Telehealth Grantees

Grantee Characteristics

The subset of the AHRQ grantees and contractors who have implemented, or are in the process of implementing, telehealth interventions are from geographically diverse regions of the United States; all but two are from rural areas (Table 1). The majority of these projects connect rural clinics and facilities with large academic medical centers to provide access to certain medical specialties. Two implementations occurred in intensive care settings (ICUs), and two occurred in both long term care settings and patients' homes.

Table 1: Characteristics of Profiled Projects

Grant	Region	Rural/ Urban Projects	
Creating Online Neonatal Intensive Care Units (NICU) Networks to Educate, Consult & Team	Southeast	Rural	Integrated Delivery System (IDS) – ICU
HIT-based Regional Medication Management Pharmacy System	Midwest	Rural	Critical Access Hospital – Pharmacy
Home Heart Failure (HF) Care Comparing Patient-Driven Technology Models	Midwest, Northeast	Rural	Long Term Care – Home Health Care
Implementing Technology to Transform Quality in SE Kern County	West	Rural	Primary Care – Adult
Measuring the Value of Remote ICU Monitoring	Southwest	Urban	Integrated Delivery System (IDS) – ICU
Project ECHO (Extension for Community Healthcare Outcomes)	Southwest	Rural	Integrated Delivery System (IDS) – Primary Care – Adult
Technology Exchange for Cancer Health Network (TECH-Net)	Southeast	Rural	Integrated Delivery System (IDS) – Primary Care
Telewoundcare Network	Midwest	Rural	Wound Care – Long Term Care – Home Health Care
Valuation of Primary Care-Integrated Telehealth	Northeast	Urban	Primary Care – Pediatric

Technologies

All of the projects included in this analysis implemented some type of telehealth application, but the ways in which they used telehealth were diverse. The only commonality among all of these grantees was that they have sought to use telehealth to connect small facilities with larger facilities or networks of facilities. The telehealth projects fell into four distinct areas: (1) provider-to-provider communication with patient present; (2) provider-to-provider communication without patient present; (3) telemonitoring; and (4) health education. The full range of telehealth interventions are presented in Table 2.

Provider-to-provider with patient present – typically involves the patient and his or her primary care provider interacting with a remote specialist via video-conferencing or other real-time telehealth technology. Some grantees have enabled patients to interact remotely with primary care providers while in the company of allied health professionals.

Provider-to-provider without patient present – typically involves the transmission of medical or health information such as x-rays, lab results, or prescriptions from one provider to another for a consultation or interpretation. This often includes dialogue between the providers. A typical example of such an interaction would be a primary care provider sending a patient's x-ray to a radiologist for interpretation and discussion of findings.

Telemonitoring (or remote monitoring) – involves the use of telehealth to remotely monitor health status. Data, such as weight, blood pressure, or glucose level, are captured via medical devices in the patient's home and then transmitted to a provider system via the Internet. Nurses and physicians can use the data to suggest changes in a patient's treatment, advise patients to seek care, or alert providers of potential complications. Some systems use algorithms so that a patient can receive computer generated or telephony prompts for next steps in their care.

Health education – involves the distribution of, or enables access to, educational content such as curricula, lectures, and computer-based training programs to health care professionals or patients via the Internet or other telecommunications. This includes the use of teleconferencing to enable health care professionals to participate in lectures on evidence-based medicine techniques or to discuss strategies to address regional health issues.

Table 2: Technology of Profiled Projects

Grant	Interventions(s)	New/ Expansion	Specific Interventions
Creating Online Neonatal Intensive Care Units (NICU) Networks to Educate, Consult & Team	Health education	New	Videoconferencing, as well as DVDs and CD-ROMs, to educate NICU staff and patients
HIT-based Regional Medication Management Pharmacy System	Provider-to-provider interactions without patient	New	Tele-pharmacy system to connect nurses with pharmacists during after-hour shifts in 10 regional hospitals
Home Heart Failure (HF) Care Comparing Patient-Driven Technology Models	Telemonitoring	New	Remote monitoring of patients in their homes, using devices such as such as blood pressure cuffs and scales (weight)
Implementing Technology to Transform Quality in SE Kern County	Provider-to-provider interactions without patient	New	Tele-ophthalmology system for diabetic retinal screening
Measuring the Value of Remote ICU Monitoring	Telemonitoring	Expansion	Remote monitoring of ICU patients from a central location during after-hour shifts
Project ECHO (Extension for Community Healthcare Outcomes)	Provider-to-provider interactions without patient; Health education	Expansion	Remote case management using a network of primary care clinics and academic specialists for targeted diseases
Technology Exchange for Cancer Health Network (TECH-Net)	Provider-to-provider interactions with patient	Expansion	Remote consultation for patients undergoing oncology (cancer) treatment by specialists with primary care involvement
Telewoundcare Network	Provider-to-provider interactions with patient	Expansion	Remote treatment of adults in home health and long term care settings by wound care and other specialists
Valuation of Primary Care-Integrated Telehealth	Provider-to-provider interactions with patient	Expansion	Remote examination of children in school-based clinics and childcare facilities by primary care providers

Findings

The grantee interviews provided detailed information about the successes, failures, and lessons learned from the AHRQ-funded telehealth implementation projects. The grantees identified various technical and organizational issues and challenges, which are discussed in detail below. Technical issues included: security, image resolution, and technical support. Organizational issues included: using telehealth technologies to follow evidence-based practices, teamwork and organizational culture, and provider retention in rural areas.

Technical Challenges

Although not unique to telehealth implementations, common technical challenges reported by grantees include security, image resolution, and technical support.

Security

While robust security measures are required to ensure that health information remains private, they also present challenges to connecting disparate health care organizations. Common security technologies, such as firewalls, can prevent organizations and individuals from sharing information and accessing health care IT resources.

Grantees reported that this challenge can be resolved by customizing IT security device settings to enable telehealth connections, while maintaining strict security protocols. However, this often requires the participation and cooperation of many individuals, not just IT department personnel. It may also require revising organizational policies in order to allow external sites to connect via telehealth equipment. Changing organizational policies requires buy-in from organization leaders who understand the value of telehealth for providers and patients.

In time, security protocols and methods will evolve. In the meantime, however, telehealth coordinators and network developers will continue to wrestle with issues of speed versus security. Virtual private networks (VPNs) are increasingly providing a secure way to establish point-to-point connections for telehealth visits. Currently, connections using VPNs can be

slow, especially when one end of the connection does not have a high-speed connection to the Internet. The speed of VPNs will improve over time, or this technology may be replaced by a faster technology for secure connectivity.

Image Resolution

High-resolution, quality videos and images require a significant amount of network bandwidth (the maximum capacity for data transfer available to an information system or organization). Low-resolution videos and images require less bandwidth, but they provide poorer quality images that may be blurry. Although high-resolution technologies are often necessary for providers to accurately interpret the results of an image or scan, in some instances low-resolution images have been shown to provide enough detail to permit clinical diagnosis.[34] Careful evaluation of potential solutions through a pilot or demonstration project is necessary to ensure that telehealth applications offer image resolution that is high enough to avoid introducing errors into the patient care process.

Two examples from the AHRQ portfolio illustrate the benefit of piloting a telehealth system to test image resolution prior to full implementation. One project that implemented a tele-pharmacy system reported that image resolution was a major challenge, causing significant delays in project implementation. The project had completed a typical vendor selection process to choose video cameras, which were deemed sufficient during a vendor demonstration. Yet once the project went live, the investigators discovered that the image resolution was not sufficient to enable accurate interpretation of letters and numbers on small pills. They were required to conduct a second vendor selection process and test multiple cameras to solve the problem. These delays significantly impacted the implementation schedule in all ten hospitals that were involved in the project. Such delays could have been avoided with a more robust technical evaluation in a pilot project.

The second project implemented a tele-wound care program in patients' homes and long term care settings. It illustrated the benefit of conducting several cycles of pilot demonstrations to find the optimal technology intervention. In contrast to the previous project, investigators found that inexpensive digital cameras were sufficient for taking and transmitting pictures of wounds over low bandwidth connections such as telephone lines.

Investigators also determined that, due to the physical limitations of some elderly patients, the telehealth equipment needed to be flexible enough to move 360 degrees around the patient to obtain photos. By conducting several pilot tests to search for appropriate, efficient, and low-cost equipment, the investigators found that small, portable digital cameras offered the most cost-effective way for a patient or caregiver to document a wound or lesion and to upload the image to a network or electronic medical record.

Technical Support

Reliable, efficient, and cost-effective technical support is required for telehealth programs to be successful. For those grantees at large academic medical centers, technical support was provided by internal IT departments that were already supporting a wide variety of health IT systems. However, for rural programs or those in small hospitals and practices, technical support remains a significant challenge. Telehealth program support was funded by AHRQ for the duration of the grant period, but several grantees expressed concern about being able to identify continuing support for systems after the end of the grant period. In rural areas, support is often provided by a consultant or vendor who is located at a distance from the hospital or practice. Such support when IT systems malfunction or require a lengthy diagnosis can cost hundreds of dollars per hour. In some instances, support cannot be provided remotely, forcing the organization to incur the expense of an onsite technical support visit.

To address this issue, one of the telehealth projects became involved in a regional organization designed to support small and rural health care organizations. This collaborative IT support company was founded by ten critical access hospitals. Each member hospital paid annual dues in return for IT support services. The company provided regular maintenance and support functions for its members, as well as IT leadership for new projects. While the model may not work in every community, it was effective for this grantee and has proven effective for safety net providers.[35]

One grantee reported a significant oversight in its vendor support contract. A clause in the contract indicated that support would only be provided Monday through Friday between 9 a.m. and 5 p.m. or "normal business hours." The investigators were unable to convince the

vendor to provide 24-hour support, seven days a week, even though the remote monitoring systems were considered "mission critical" applications necessary for the provision of critical care. This underscores the need to consider technical support needs upfront when selecting and writing a contract with a vendor.

Organizational Issues

Grantee interviews revealed that organizational issues are as important as technical challenges; this finding is supported in the literature.[36,37] When asked about organizational issues, AHRQ grantees said that implementing telehealth had resulted in a number of organizational improvements in the areas of evidence-based practice, teamwork, and provider retention in rural areas.

Evidence-Based Practice

Technology reuse (i.e., using technology for additional tasks beyond its primary role) is common. For example, cell phones often have a feature that permits the transmission of e-mail. Although telehealth primarily serves as a channel for communication about a patient, it can also be used for distance education by delivering evidence-based practice information to remote clinicians. Grantees reported that this functionality is easy to implement once the telehealth infrastructure is in place. This capacity offers one way to increase the return-on-investment in telehealth.[38]

One AHRQ grantee designed a telehealth network to support patient care and meet providers' needs for continuing education. This project engaged providers throughout the State in a "learning network." This network enabled primary care physicians to consult with specialists from the region's academic medical center to improve care for patients in rural parts of the State. The physicians described specific cases to the group of specialists and primary care providers, and received feedback on how they might improve disease management. They also obtained advice about the latest evidence-based techniques for chronic and complex disease management. These interactions helped participating physicians to improve their ability to treat and manage complex diseases.

This project was later expanded to address a secondary goal of offering provider education to nurses and other practice staff. Members of the practice team received distance education and training about patient safety and electronic health records, as well as information about how they could use community resources to support improved continuity of care for patients.

A tele-wound care program, in which a single wound care specialist remotely treated patients in 15 counties, offered training sessions via telehealth to home health and nursing home staff. Once the clinical component of the program had been successfully implemented, the wound care specialist was able to use the telehealth equipment to educate staff about the latest evidence-based practices in the treatment and management of wounds. Staff members were then able to use this knowledge to better care for their patients.

An additional project developed a regional telehealth network that connected local primary care providers with a remote ophthalmologist in a nearby town. Local clinicians recognized that, in keeping with evidence-based guidelines, their patients needed regular eye exams, including screenings for diabetic retinopathy. The community embraced the idea of using telehealth to locally screen diabetic patients and transmit their results to an ophthalmologist for interpretation. A primary outcome of the network's efforts was a significant increase in the number of diabetic patients who received regular eye screenings. The network improved the area's overall quality of care and enabled clinicians to better serve their patients. It also eliminated the need for patients to travel to receive screenings and increased demand for the ophthalmologist's services in the nearby town.

Teamwork and Organizational Culture

Because patients often see multiple providers across many organizations, a team-based approach is needed to coordinate the activities of various care providers. Yet coordinating this care can be challenging. Care is often delivered in several physical locations, and geographic distances between team members limit communication. Telehealth supports and enhances team-based care by connecting providers remotely to foster collaboration and health information exchange.

A telehealth system implemented in the intensive care units at three hospitals demonstrated this type of team-based approach. The remote monitoring application, often referred to as tele-ICU, involved around-the-clock, central monitoring of remote ICU beds by hospital intensivists and critical care registered nurses. This application of telehealth provides the remote clinicians with live video of patients, real-time vital statistics monitoring, and access to clinical information in the patients' electronic health records.

As part of the evaluation, the investigators administered surveys to ICU providers to measure teamwork and culture of safety both pre- and post-tele-ICU implementation. They found that providers at all three sites reported improved attitudes about teamwork and the culture of safety following tele-ICU implementation, with nurses reporting the greatest improvements. Because nurses frequently provide frontline care for patients, their interactions with the remote tele-hospitalists typically involved feedback on safety concerns and performance. Nurses also reported that the tele-ICU facilitated learning and increased interactions between the bedside and remote clinicians. Telehealth created opportunities for the clinicians to ask questions and get help.

Another project, which implemented telehealth to support remote interactions with pharmacists after regular business hours, found that their telehealth network increased communication and camaraderie between nurses and pharmacists. Nurses reported being more comfortable contacting the pharmacy with questions about patients' medications, and pharmacists were more responsive to inquiries about providing medications after hours.

Provider Retention in Rural Areas

Rural communities often face significant challenges in retaining health care providers. Rural providers can often feel isolated and may wish to be part of a more active community of professionals than is present in many rural areas. Telehealth can increase provider retention by connecting rural providers to a network of peers from other rural and urban communities.

Project ECHO, the project that developed the learning network of physicians and other health care professionals, surveyed providers following their telehealth implementation. In addition to feeling more confident in treating chronic and complex diseases, these providers

reported higher satisfaction with their jobs. Physicians reported that the telehealth sessions helped them to network socially with other physicians. Prior to the telehealth project, physicians would have had to drive more than 100 miles to engage in networking activities. Medical practices also reported lower rates of turnover among nurses and other clinic staff. The investigators learned that the practice staff enjoyed interacting with peers at other practices and felt connected to their profession in a way they had not prior to the implementation of the telehealth network.

Conclusion

AHRQ has funded a diverse set of health IT projects to examine how applications such as telehealth can improve the quality, safety, efficiency, and effectiveness of health care. The telehealth projects described in this report have brought to light a number of important lessons about the challenges and opportunities associated with introducing telehealth applications into real-world clinical settings. It is the hope of AHRQ and its National Resource Center for Health IT that others who wish to implement and use telehealth can learn from the experiences of these AHRQ projects.

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