Benefits of Telemedicine in Remote Communities & Use of Mobile and Wireless Platforms in Healthcare

Alexander Vo PhD, G Byron Brooks MD EE,

Ralph Farr, and Ben Raimer MD, University of Texas Medical Branch

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Executive Summary

One of the greatest challenges facing the U.S. healthcare system is to provide quality care to the large segment of the population, which does not have access to specialty physicians because of factors such as geographic limitations or socioeconomic conditions. The use of technology to deliver health care from a distance, or telemedicine, has been demonstrated as an effective way of overcoming certain barriers to care, particularly for communities located in rural and remote areas. In addition, telemedicine can ease the gaps in providing crucial care for those who are underserved, principally because of a shortage of sub-specialty providers. At the University of Texas Medical Branch (UTMB Health), the use of telecommunications technology for the purpose of improving health care delivery to rural and underserved populations of Texas has been part of one of its core programs since the mid 1990s. Since 1995, clinicians and researchers at UTMB have been testing, refining and utilizing telemedicine and telehealth technologies to improve and develop telemedicine – solving the problems of access to quality medical care.

From UTMB's experience in telemedicine, the use of telecommunications technologies and connectivity has impacted real-world patients, particularly for those in remote communities. This work has translated into observable outcomes such as:

- improved access to specialists
- increased patient satisfaction with care
- improved clinical outcomes
- reduction in emergency room utilization
- cost savings

Given the various benefits observed through the provision of health care via telemedicine, there is a tremendous amount of momentum toward increasing access to care through the use of health information technologies, thereby creating an exciting and central role for innovation and implementation of new and advanced platforms for service delivery. Two such platforms include the use of wireless and telemonitoring technologies. It is our belief that healthcare delivery is about to make a significant leap forward. The development and installation of high-speed wireless telecommunications networks coupled with large-scale search engines and mobile devices will change healthcare delivery as well as the scope of healthcare services. It will allow for real-time monitoring and interactions with patients without bringing them into a hospital or a specialty care center. This real/near-time monitoring and interacting could enable a healthcare team to address patient problems before they require major interventions, creating a potentially patient-centered approach that could undoubtedly change our expectations of our healthcare system.

Introduction

The use of technology to deliver health care from a distance, or telemedicine, has been demonstrated as an effective way of overcoming certain barriers to care, particularly for communities located in rural and remote areas. In addition, telemedicine can ease the gaps in providing crucial care for those who are underserved, principally because of a shortage of sub-specialty providers.

Nowhere are these benefits more evident than in Texas. With a land mass area of 268,820 square miles and a growing population of 25.1 million, Texas is the second largest US state by area and population.1 Its population growth rose more than 18.8 percent between 2000 to 2009, reflecting an increase that is more than double the national growth in this period.2 This rapid growth is attributed to a diversity of sources such as natural increases from the total of all births minus all deaths and to a high rate of net in-migration from other states and countries. Along with the increase in population, an ever-growing aging population (the state's older population, 65+, is expected to double that of the previous 8 years) has significantly affected the demand on the healthcare workforce as demands for quality care increased.

In its Statewide Health Plan 2011-2016 report[2], the Texas Statewide Health Council concluded:

"Texas faces particular challenges with respect to physician and other healthcare workforces not primarily because of an overall shortage, but because of sharp disparities in the allocation of healthcare resources to different parts of the state. In the metropolitan areas outside the border, there is one physician in direct patient care for each 573 county residents. In the 32-county border region and in non-metropolitan Texas, the ratios are 2 to 3 times as high."

Although the overall supply of physicians has increased in Texas since 2000 from in-migration, the vast majority of these healthcare professionals resides and practices within four primary areas of Texas: Dallas, Houston, Austin, and San Antonio. Moreover, Texas has consistently lagged behind the US average in the ratio of physician supply per 100,000 of population, and the gap between the two appears to be increasing.2 In 2009, there were 25 counties with no physicians, and the counties with lowest ratios of providers to populations were by and large in West Texas, South Texas and the Panhandle.

Theoretically, resources such as healthcare would be distributed across the state in accordance with population density and needs. Realistically, however, geographical and economic barriers create significant disparities across the state, with rural and underserved communities enduring significantly greater barriers to accessing the care continuum. The supply ratios for a number of health professionals, including primary care physicians and mental health professionals, are lowest in rural, border and other health professional shortage areas. Data for 2009 indicated that out of the 254 counties in Texas, 118 counties are designated as whole county primary care Health Professional Shortage Areas (HPSAs) due to primary care doctor to patient ratios of 1:3500 or less, and 173 counties (68 percent of the state) are designated as whole county mental health HPSAs[2]

Telehealth Need

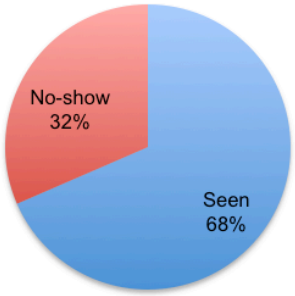
In Texas, communities are struggling to care for an increasing number of underserved, disadvantaged, and at-risk populations. In most communities, especially in rural areas, care is not organized to promote prevention and early intervention, coordinate services, or monitor access to and quality of care. Moreover, public and private funding to subsidize care remains inadequate, despite growing community needs associated with increases in the uninsured and aging populations. Consequently, many people are left to seek care in emergency rooms, often as a last resort, in an unmanaged and episodic manner. The costs of such care are borne by care-giving institutions, local governments, and, ultimately, taxpayers, many of whom are already burdened with the costs of meeting health-related costs of their own.

The University of Texas Medical Branch (UTMB Health) has responded to these challenges by taking steps to design and implement new and innovative ways of providing care and educating health professionals to serve these special populations. Evolved from its correctional and maternal child wellness programs, UTMB Health Telemedicine has expanded into numerous settings to include community health clinics, community mental health centers, corporate employee health programs, cruise ships, off-shore industries, and remote areas of the world. To date, UTMB Health has conducted more than 600,000 synchronous physician-to-patient telehealth encounters, and has averaged, within the past few years, more than 92,000 face-to-face telehealth encounters per year.

UTMB Health is the only entity in the state that provides comprehensive healthcare services to low income populations statewide. Several rural healthcare delivery sites in seven counties currently have the technology necessary to access telemedicine services through UTMB Health in Galveston. The populations currently being served include low-income women and children, special needs children, the frail and elderly, and underserved children and adults. In addition, and because low-income populations in Texas are disproportionately minority, UTMB Health has developed partnerships statewide with many providers and educational institutions that serve high numbers of patients from low-income minority populations.

For example, in the face of a shortage of pediatric psychiatric specialists and given the social mandate to provide access to quality medical care to eligible and enrolled Medicaid children, the Texas Health and Human Services Commission (HHSC) awarded a Frew Advisory Committee sponsored contract to UTMB Health to develop, in collaboration with community partners, implement and operate telemedicine clinics specifically for pediatric tele-psychiatry, aptly named the UTMB Telehealth Network for Children – UTNC, to serve children enrolled in the Texas Medicaid program in 2009. Many of these children live in communities without local pediatric psychiatric providers. Several of these clinics were in need of a Spanish-speaking pediatric psychiatrist and all of these children live in rural communities where pediatric psychiatric services are limited, overburdened and scarce. As has been noted in many reports addressing access to care for Medicaid children, the major barrier to adequate medical care continues to be the mal-distribution of medical specialists. Our current clinical partners continue to tell us that the availability of our telemedicine clinics has made it possible for their communities to offer care to patients who would normally not have been able to receive any psychiatric care from a trained child psychiatrist.

Figure 1: UTNC Telemedicine Encounters

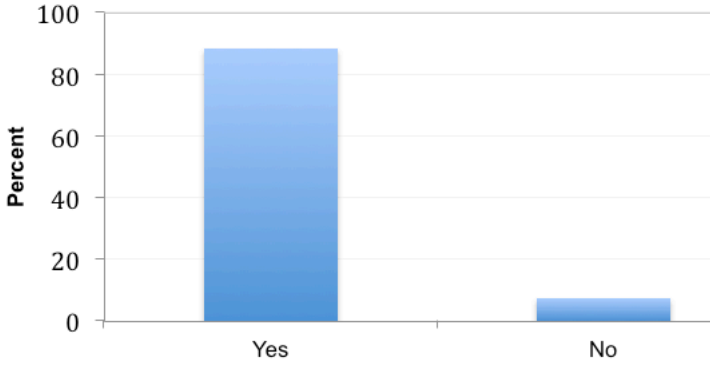


To date, this program has scheduled more than 11,353 appointments for Medicaid children located in 20 different clinical partnered sites across the state of Texas and has provided more than 7,775 real-time clinical encounters.

Along with the number of patients scheduled and seen in the UTNC Clinics, Figure 1 reveals the no-show rate as we continue to implement clinics through the first year of the award. To date, UTNC average no-show rate is 32 percent, significantly lower than the national average for this patient population. Previous reports on the Medicaid patient population have indicated a high appointment no-show rate, on average of 42 percent. 3 This no-show rate can be as high as 70 percent in outpatient mental health treatment settings and represent a tremendous loss in productivity and revenue.[4]

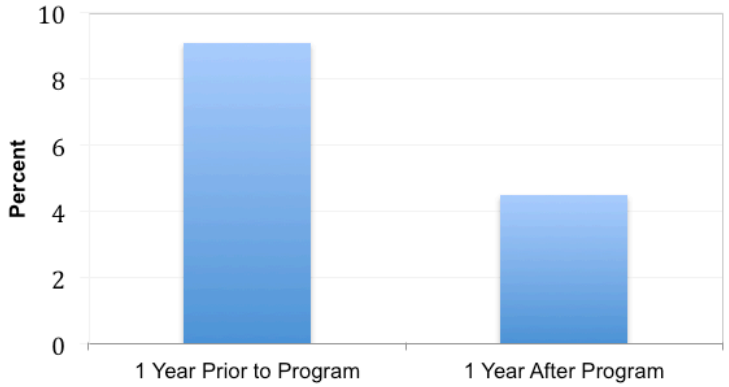
In addition to the increasing utilization of telepsychiatry for this population, the benefits for telemedicine can be readily seen through ongoing research and quality assessments. In a recent survey of 530 parents whose children received pediatric telepyshiatric care from UTMB Health, an overwhelming 88.5 percent reported that telemedicine made it easier for them to receive treatment by a specialist and more than 60 percent reported better changes in overall functioning for their children after receiving telepsychiatric services (Figure 2).

Figure 2: Telemedicine Program Made It Easier to Receive Treatment by a Specialist



Moreover, survey participants reported 50.5 percent reduction in emergency room (ER) utilization for the children's psychiatric needs for the year prior to participating in the program to the year after being in the program (Figure 3). This particular finding has implications surrounding potential cost savings, mainly through cost avoidance, associated with reduction in ER use. Using UTMB's fiscal year 2008 emergency department cost estimates with 5 levels of ER charges depending on the services provided, which ranged from $475 at level 1 to $3,734 at level 5 (charges include both technical and professional fees), speculations of cost avoidance can be calculated. Given the observation that there was a reported 50.5 percent drop of reported ER use from the year prior to participating in the program to the year after being in the program, estimated cost avoidance for this Medicaid sample alone can range from $11,514 to $90,512 depending on the level of charges rendered for at least one ER visit per respondent who reported using emergency department.

Figure 3: ER Use



When generalized to the overall total population of the UTNC project, it is reasonable to assume that the range of cost avoidance could be much more substantial.

Given the various benefits observed through the provision of health care via telemedicine, there is a tremendous amount of momentum toward increasing access to care through the use of health information technologies, thereby creating an exciting and central role for innovation and implementation of new and advanced platforms for service delivery. Two such platforms include the use of wireless and telemonitoring technologies.

Mobile and Wireless Platforms

Since the earliest science fiction portrayals of telemedicine (The Machine Stops by E.M. Forster 1909), telemedicine has been a way for a patient to reach out to his/her doctor regardless of the geographical distances between them.5 UTMB has spent the last 20 years developing patient services that use this basic model and it is clear that patients want and need to consult with their physicians at times that may not be convenient and from places not accessible by their physicians. Computer information services have made store and forward, text, still images, and video interactions with one's physician a daily occurrence.

It is not unusual for patients in developed nations to routinely meet with their physician via real-time teleconferencing. Typically these sessions involve the physician reviewing an electronic medical record that contains the patient's history and laboratory findings, imaging studies and other medical testing done in typical medical centers. Through this exchange of data and a real-time discussion with the patient, many routine and specific medical problems can be well managed and treated. With the addition of patient-side diagnostic instruments (such as stethoscopes, cameras, blood test and skilled medical technicians), the range of medical services provided via telemedicine rapidly expands. Today, a child in rural Texas can be treated by a specialist without traveling to the specialist's office; a new mother can get advice from her child's pediatrician late into the night from her home; and a rural emergency department can get a consult from a specialist in an

urban setting on how to treat a patient with a stroke. All of these examples in healthcare delivery were brought about by the implementation of our high-speed data transmission infrastructure. It is our belief that healthcare delivery is about to make a significant leap forward. The development and installation of inexpensive high-speed wireless telecommunications networks coupled with large-scale search engines and handheld smartphones will change healthcare delivery as well as the scope of healthcare services.

With more than 302 million wireless subscriber connections and more than 26 percent wireless-only households in the United States, mobile phones have become a ubiquitous element in American life. Moreover, the handheld smart phone and its data network constitute the game-changing technology that will affect how we view our healthcare providers and the health care system.6 Today's smartphones are not only powerful computing devices (1 to 1.5 GHz processors) connected to a worldwide, high speed data network, but they can also be configured with various onboard applications that connect to special sensors via a standard wireless interface (Wi-Fi or Bluetooth). In addition to the underlying hardware, these devices now support powerful standardized software operating systems like Android and iOS. This powerful computing system, capable of networking with local and distant devices, opens an interesting set of healthcare possibilities.

Today, a physician can realistically conduct a videoconference with a patient from both of their mobile devices. While that is considered amazing, it is not much different than the telemedicine consultations conducted between two different medical clinics or a physician's office and a patient's home. In fact, this mobile platform-based conference is not very different from the telemedicine consultation envisioned in 1909 by E.M. Forester. The addition of real-time biometric monitoring or telemonitoring with data fusion made possible by our high-speed wireless data networks adds a level of sophistication and is part of our immediate future.

A modern smartphone (or mobile platform) can take on many functional forms. They can be as small as an old fashioned matchbox or a 10-inch tablet. This mobile platform can foreseeably be connected wirelessly to physiologic monitors worn on a patient's body or embedded into a patients garment. Physiological monitors may be configured into a home health/ medical station with minimal space requirements. Some of the small monitors such as blood glucose, blood pressure, temperature, kinematic, EKG, imaging and electromagnetic field monitors are currently available and can foreseeably be interfaced with portable micro sample blood chemistry test sets, which are also available today. It is not difficult to imagine a patient being given a specific set of monitors tailored to his or her specific health care needs, and the data from these monitors and systems can be routed to the physician for either evaluation or to a monitoring program designed to give the doctor an alert or warning based on observed findings.

The use of this wearable/portable embedded physiological and cognitive monitoring system will enable a medical team to closely monitor patients without bringing them into a hospital or a specialty care center. This real/near-time monitoring could enable a healthcare team to address patient problems before they require major intervention in a specialty care center. This monitoring can be ideal for managing chronic conditions such as diabetes, hypertension, and cardiovascular disease and has been shown to reduce hospitalization and, in some cases, reduce mortality rates.7,8 The collection and integration of patient data could also be used by medical teams to tailor patient educational sessions that address actual observed patient conditions. Moreover, these patient education or consultation sessions can now be delivered directly to patients via their smartphones.

The vision of providing tailored medical care and services to remote patients is exciting and offers the promise of better and more effective healthcare. This potentially patient-centered approach and convenient access to healthcare services offered over a wireless network will undoubtedly change patients' expectations of their healthcare system and service providers. This readily available information network will also change society's expectations of our medical system. It will become a standard of care to offer and deliver proactive patient educational/ informative sessions. These sessions could be face to face and in person, but economics will probably favor distributed text or video messages tailored to the specific needs of the individual patient. The often mentioned medical home will, in most likelihood, be a virtual medical home

distributed over a secure wireless network accessible by the patient and his/her healthcare team regardless of who is part of the team today or where the patient is located.

The standardized platform and operating systems of mobile platforms coupled with the ability to collect and manage large distributed data sets opens the way to not only targeted health care to individual patients but to targeting health care to entire populations. Through the application of data mining and data fusion techniques along with anonymous geographical information, we may be able to monitor a disease as it emerges and migrates across our nation. Distributed systems that monitor body temperature could be used to track probable influenza outbreaks, and examining consultations for nausea and diarrhea could help identify a contaminated food distribution chain. Given the ability to collect and use unprecedented amounts of patient and population information in near real-time presents opportunities unimagined 10 years ago.

In addition to offering the healthcare community a better way to serve our patient population, this ability to capture and use data poses real and imagined risk. The medical and the telecommunications industries will have to develop plans and policies to protect individual patients from privacy violations, particularly with issues surrounding access to medical information, confidentiality and security. Methods of ensuring privacy such as controlled access, encryption and authentication can and must be employed to assist in securing and protecting privacy of medical data.

The use of advanced technology to deliver healthcare at a distance has the potential to be one of the defining medical revolutions of the 21st century. With the unwieldy U.S. healthcare system under scrutiny, telemedicine can be one of the answers for increasing access and, at the same time, decreasing the cost of healthcare delivery. Advances in sensor networks are making remote monitoring an actuality, contributing to a level of quality of care that is unprecedented. As such, more momentum is needed to not only sustain, but also enhance acceptance of telemedicine as a viable and effective mean of healthcare delivery.

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