

# Telemedicine

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## ABSTRACT

*Telemedicine has been advocated as a solution to overcome barriers to access health services faced by rural patients. The almost 60 million Americans living in rural areas are significantly underserved by the nation's physicians and rural communities have traditionally experienced a shortage of physicians. Compounding this problem of physician shortage is the fact that services must be provided to patients over a wide geographic area.*

*Telemedicine programs are being used to address health services shortages in rural areas by applying telecommunications technology to deliver health services similar to those which would be provided in face-to-face consultations between patients and health care professionals. Adoption of telemedicine as an option for delivery of services has been slow and is largely limited to specialty services. Where adopted, telemedicine has been received positively by both patients and physicians. Telemedicine can improve access to care for rural patients by increasing the number of patients who can access care and by providing services usually unavailable to rural patients. Despite evidence of the effectiveness of telemedicine programs, wider adoption of a telemedicine alternative suffers from a lack of reliable financial data for implementation, ongoing management, and for comparison to traditional delivery systems. Telemedicine is poised to become an important method of rural health care delivery, but as the trend toward the application of technology to the delivery of health services gains greater momentum, health managers require serious quantitative evidence on which to base resource allocation and management decisions.*

**Keywords:** Telemedicine; Health

## INTRODUCTION

lose to 60 million Americans live in rural areas (United States Census Bureau, 2012). Despite representing almost twenty percent of the population, rural areas are only served by a little more than ten percent of the nation's physicians (Rosenblatt, Chen, Lishner, & Doescher, 2010). Consequently, there traditionally has been a shortage of physicians serving rural communities, and this trend is expected to continue for the foreseeable future (Chen, Fordyce, Andes, & Hart, 2008). Compounding this problem of physician shortage is the fact that services must be provided to patients over a wide geographic distribution. The ratio of physicians to people in rural areas is 113 to 100,000 compared to a rate of 209 per 100,000 people in urban areas (Rosenblatt et al., 2010). Nurse practitioners and physician assistants provide an important resource to supplement primary care physician shortages in rural areas (UnitedHealth, 2011). The shortage of physicians has led to the development of a rural health care delivery system that relies heavily on nurses, nurse practitioners, and other non-physician health professionals to deliver primary care services. The scarcity of specialty care is more problematic for rural patients which means that rural patients must travel long distances to access care or forego specialty care entirely (UnitedHealth, 2011). Scarce physician resources allocated over a large geographic area dramatically reduce access of rural patients to health services. Rural patients, therefore, navigate a health care delivery system where face-to-face consultations are infrequent with limited communication and minimal coordination of care between visits (Fortney et al., 2011).

Telemedicine has been advocated as a solution to overcome barriers to access health services, in particular, the geographic barriers faced by rural patients (LeRouge, Tulu, & Forducey, 2010). Telemedicine is the application of telecommunications technology to deliver the same health services as those which would be provided in face-to-

face encounters between patients and health care professionals (Thielst, 2010). It has been adopted slowly despite being generally accepted as a delivery model that can address rural health care disparities caused by geographic distances and shortages of health resources (Kraetschmer et al., 2009). The use of telemedicine as a delivery model of care to rural patients is in transition as it experiences wider adoption. Widespread implementation has been affected by concerns of 1) reimbursement, 2) economic and clinical benefits, 3) malpractice, 4) acceptability to providers and patients, and 5) technological requirements (Ghosh & Ahadome, 2012). Although these obstacles have inhibited private investment, governments and public institutions have recognized telemedicine's potential to improve access to care (LeRouge, Tulu, & Forducey, 2010). [Telemedicine programs have been adopted by a number of states to address health services shortages in rural areas and both Medicare and Medicaid increasingly provide reimbursement for the services provided through telemedicine methods (Brewer, Goble, & Guy, 2011; Krupinski et al., 2011; Weinstein et al., 2008; U.S. Department of Health and Human Services, 2012).] The U.S. Department of Health and Human Services has established the Office for the Advancement of Telehealth within the Office of Rural Health Policy to promote telehealth technologies for health care delivery. The U.S. Department of Agriculture recently funded telemedicine projects to improve access to healthcare in rural areas (U.S. Department of Agriculture, 2011). The Veterans Administration (VA) is the largest single adopter of telemedicine as a method of health care delivery. With more than 40% of the veterans it serves living in rural areas, the VA has been praised for implementing a telemedicine program which successfully served over 50,000 patients in 2011 (2020Health, 2012).

### **Current Standard Of Practice**

The current standard of practice for delivering care to rural patients remains the face-to-face consultation. An important feature of current practice is telemedicine's application almost exclusively to specialty care (Graves, 2010). The shortage of specialists in rural areas is well-documented (Graves, 2010). Providers use technology to provide specialty services in the form of direct patient consultation, provider-to-provider consultation, or for monitoring and patient self-management (UnitedHealth, 2011). Specific health issues of particular concern to rural populations are diabetes, cardiovascular disease, cancer, critical care, and mental health services (UnitedHealth, 2011). Telemedicine has been demonstrated as effective in treating these specialties for rural patients (Toledo, Triola, Ruppert, & Siminerio, 2012; Linderman, Koff, Freitag, Min, & Vandivier, 2011; Doolittle, Spaulding, & Williams, 2011; Zawada et al., 2009).

Current standard of practice does not require using telemedicine as a method to deliver health services to rural patients; it is not a practice norm except where it has been developed and promoted locally. Where patients have been made aware of both traditional and telemedicine care, providers have seen an increase in the number of patients utilizing the telemedicine options (Doolittle, Spaulding, & Williams, 2011). Rural patients may actually prefer telemedicine delivery of care when given the choice between telemedicine or traditional consultations (Doolittle et al., 2011). Both patients and providers perceive telemedicine as increasing their access to services that would otherwise be unavailable to them (Toledo et al., 2012). Perception of access can be a strong measurement of potential utilization of health services (Fortney et al., 2011). Fears that patients or providers will not utilize telemedicine services appear unfounded in practice. A greater dissemination of telemedicine success stories to management is necessary to create an environment in which telemedicine's potential to improve access can be explored as a management goal (Hockenberry, Brown, & Melnyk, 2011).

Telemedicine is a broadly applied term when it comes to the specific technology requirements of implementing a telemedicine program. Core standards require that equipment be effective but do not provide detailed guidelines (American Telemedicine Association, 2007). Managers should be cognizant that the research may not clearly define the technology or the rationale supporting the type of equipment applications and they must seek a better understanding of available technology and how it can be implemented in clinical practice. The dramatic improvement in videoconferencing capabilities has improved the quality of patient and provider consultations (Federation of State Medical Boards, 2011). Sophisticated remote monitoring devices that can provide instructions or assistance with medication adherence may offer opportunities for patient self-management (Linderman et al., 2011). Although videoconferencing and monitoring devices currently appear to be the preferred method, technological systems and methods appropriate to the delivery of health care services are continually and quickly evolving. Knowledge sharing among health managers is essential to adopting the most effective technologies as they develop (Thielst, 2010).

Even successful telemedicine applications must rely on local practitioners. The patient must be assisted by a physician, nurse, nurse practitioner, or other health professional during the consultation (Davis et al., 2010; MacLeod et al., 2009; Pyne et al., 2010; Switzer et al., 2010; Toledo et al., 2012; Zawada et al., 2009). Teleconsultations may also occur between local health professionals and off-site practitioners (Zawada et al., 2009; MacLeod et al., 2009). Even remote monitoring devices require a local practitioner to assist with initial education and implementation. Sophisticated software and programming can generate tailored instructions to the patient, but the transmitted data must still be reviewed by a practitioner and followed by periodic local consultations (Linderman et al., 2011). The fear that the patient's lack of experience with technology creates a barrier to accessing telemedicine health services is not borne out in practice. It is the practitioners, not the patients, who must acquire familiarity with using technology. The use of telemedicine does not obviate the need for local health professionals, but provides the rural patient with access to a level or type of health services otherwise unavailable in the patient's area.

### **Presentation Of The Evidence**

Seven intervention studies (Davis et al., 2010; Linderman et al., 2011; MacLeod et al., 2009; Pyne et al., 2010; Switzer et al., 2010; Toledo et al., 2012; Zawada et al., 2009) were critically appraised; two involved videoconferencing in the treatment of diabetes, one study used videoconferencing in the treatment of depression, one used videoconferencing and telephone consulting in the identification of stroke victims, one used videoconferencing to support examination of sexual assault victims, one study used videoconferencing to provide support services to rural intensive care units, and one study used remote electronic devices to monitor and deliver instructions to rural patients suffering from chronic obstructive pulmonary disease.

#### *Study # 1*

Toledo and colleagues (2012) conducted a well-designed control trial of twenty-five (25) diabetes patients and seven (7) primary care providers, without randomization, to determine whether rural diabetes patients and their primary care providers were willing to accept telemedicine consultations as a method of health care delivery. Participants were located in rural areas not served by a local endocrinologist. Each patient was assisted by a diabetes nurse in a single teleconsultation with an endocrinologist to develop a treatment management plan. Patient and provider satisfaction were obtained from satisfaction questionnaires and glycosylated hemoglobin (HbA1C) measurements were obtained from the participants' medical records. Both patient and provider satisfaction with their telemedicine experience was high and there was a measurable improvement in patients' glycemic control.

#### *Study #2*

Switzer and colleagues (2010) conducted a well-designed control trial consisting of twenty-eight (28) patients experiencing either intracerebral hemorrhage or ischemic stroke, without randomization, to determine if telemedicine could improve the enrollment of rural patients into acute stroke trials. Rural patients are usually not represented in acute stroke trials because of the patients' distance from the medical centers conducting the studies. The study was applied to two acute stroke trials being conducted at the Medical College of Georgia (MCG), evaluating treatments of intracerebral hemorrhage and acute ischemic stroke. Both a comprehensive videoconferencing system and a telephone-only system were utilized to identify, evaluate, and enroll patients who presented themselves to rural facilities that lacked acute neurology specialists and intensive care units. Data were collected concerning the number of patients that were qualified and enrolled in the study and the time elapsed from symptom onset to study start and treatment. These findings were compared to those of patients who presented themselves directly to MCG. The results indicate that the comprehensive videoconferencing system was highly effective in recruiting rural patients into the trials who presented themselves to remote facilities. The processing time to begin treatment was also reduced. The telephone-only system did not result in any enrollees, even though it identified potential participants.

*Study #3*

Zawada and colleagues (2009) conducted a well-designed control trial without randomization to determine how the implementation of an intensive care unit (ICU) telemedicine program would impact the availability of critical care services in rural facilities. Avera McKennan Hospital (Sioux Falls, South Dakota) instituted a remote critical care program (RCCP) to address a severe regional shortage of intensivists by making its critical care practitioners available for consultation through a telemedicine system. The study assessed the RCCP's effect on three regional hospitals, two community hospitals, and nine critical access hospitals located in rural areas without a dedicated intensivist staff. In larger facilities, data were obtained from patient ICU charts to calculate hospital and ICU mortality rates, retention rates, and length of stay (LOS). Surveys were administered to the staff of the smaller facilities concerning the impact of the telemedicine program on the delivery of critical care services, the impact of the program on patients and their families, and on the need to transfer patients to other facilities. The data from the larger facilities indicated that LOS was reduced, the number of patients retained was increased, and that mortality rates were reduced or unchanged. Smaller facilities reported a reduction in the number of patients requiring transfer to other facilities.

*Study #4*

Pyne and colleagues (2010) conducted a randomized controlled trial (RCT) to determine the cost-effectiveness of telemedical care for treatment of depression as compared to that of usual care methods among patients in rural areas. Three hundred and ninety-five (395) participants in the study were patients being treated for depression at Veteran's Health Administration community-based outpatient clinics (CBOCs). Participants in the intervention and control groups both received usual medical care for depression. Those in the intervention group also received care from a Telemedicine Enhanced Antidepressant Management (TEAM) group. The TEAM was composed of primary care providers and medical professionals that specialized in depression treatment. Through the use of the TEAM, participants' abilities to access adequate medical care were greatly increased and those participants showed significant improvements in their depressive symptoms.

*Study #5*

Davis and colleagues (2010) conducted an RCT to determine the effectiveness of a diabetes self-management education (DSME) program that incorporated telemedicine compared to usual DSME care. There were one hundred and sixty-five (165) participants with clinical diagnoses of diabetes who were also required to belong to CareSouth Carolina, a type of federally qualified health center (FQHC) in rural South Carolina. The telemedical group took part in 13 diabetes treatment sessions. Three sessions were in person and the other ten were via video web conferencing. Patient health data were collected prior to the start of the study as well as at six and twelve months into the study. Relevant data included glycated hemoglobin levels (GHb), LDL cholesterol levels, blood pressure, waist circumference and body mass index. Improvements in GHb and LDL were significantly greater in the telehealth intervention group, indicating that the increased access to health professionals and telehealth resources assisted in the attainment of more favorable physiologic levels.

*Study #6*

MacLeod and colleagues (2009) conducted a well-designed control trial without randomization to determine whether or not the use of telemedicine during pediatric sexual assault consultations assisted in improving the thoroughness and quality of the examinations. The participants consisted of forty-two (42) pediatric patients requiring comprehensive examinations for sexual assault. The two hospitals that participated in the study desired to have expert medical consultants involved in their sexual assault examinations and were both located in rural communities of northern California. Live video consultation was used during each examination and the consultants were able to provide feedback and guidance on the techniques and methods being used. A standardized survey tool was developed by the researchers to evaluate the completeness of each case using the assistance of telemedicine. Results of the study indicated a significant improvement in the overall efficacy of the examinations. Many modifications were made during the examinations, through the input of the telemedical consultants, which assisted in improving the completeness of the assessments. Through the use of telemedical input, patient access to qualified and comprehensive sexual assault care was greatly improved.

*Study #7*

Linderman and colleagues (2011) conducted a randomized clinical trial to determine if a proactive model of integrated care (PIC) supported by a remote monitoring platform would improve delivery of guideline-based care for rural patients suffering from chronic obstructive pulmonary disease (COPD). An electronic device was used to monitor one hundred (100) COPD participants for patient health and identify COPD exacerbations, such as shortness of breath, oxygen desaturation, activity stress, and respiratory complications. The device also provided regular and responsive self-management instructions and education. The results showed marked improvement in quality of life. Regression analysis indicated that the initiation of medication and improvements in patient exercise explained a large percentage of the improvement in quality of life. The authors hypothesized that patient use of the electronic device for education and monitoring was an important contributor. However, the improvement attributed to the electronic device is not quantified in the study.

**Implications For Managerial Practice**

Many existing studies demonstrate that telemedicine can effectively improve access to care for rural patients by increasing the number of patients who can access care and by providing services previously unavailable in rural areas. Unfortunately, most studies either ignore the financial dimension or assert that the telemedicine method under study was effective and would achieve cost savings. There is often a presumption that telemedicine achieves cost savings because of the application of technology which is perceived as efficient. Since studies often focus on the effectiveness of delivered care, less attention is paid to the structure of the method of delivery or how a telemedicine program functions operationally. Often a telemedicine program is not a standalone operation, but leverages existing resources. Sound financial evaluation depends on more reliable formulation of programs structure. The failure to include cost analysis has the potential to slow implementation of telemedicine programs (O'Mathúna, D.P., Fineout-Overholt, E., & Johnston, 2011).

When cost data are available, it is encouraging but is limited, speculative, and can be contradictory. Cost evaluation methods vary widely. Cost savings are sometimes measured in reduced length of stay (LOS), ICU days, or reduction in patient transfers. There is some evidence that telemedicine can generate benefits in overall program savings and at least one telemedicine program appears to have experienced significant reductions in cost-per-patient over time (Zawada et al., 2009; Doolittle et al., 2011). Overall, studies have not been rigorous or comprehensive in their consideration of investment and operational costs, particularly with respect to technology, personnel, training, and facilities.

Cost is always an important consideration when making decisions to implement new systems of delivery, even when they have been demonstrated to improve patient outcomes. Future research on telemedicine needs to include cost data as a component of the study objectives. Currently, managers lack implementation and ongoing telemedicine program costs, as well as comparables to traditional delivery methods.

**CONCLUSION**

It is clear that research is needed to determine meaningful cost data before managers can seriously consider implementing telemedicine programs beyond pilots and trial programs. [One good starting point could be a review of existing telemedicine programs and pilots. These programs have already generated cost data which may not yet have been analyzed but could yield some important data without the need of establishing new trials. This could reduce research costs and also has the advantage of obtaining actual implementation costs and historical cost data.]

Telemedicine is poised to become an important method of rural health care delivery. As the trend toward the application of technology to the delivery of health services gains greater momentum, health managers require serious quantitative evidence on which to base resource allocation decisions.

## AUTHOR INFORMATION

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**NOTES**