Telemedicine and its Role in Revolutionizing Healthcare Delivery

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MARYAM ALVANDI, DHS

ABSTRACT

Telemedicine aims to meet the needs of today's healthcare consumers and has the capacity to revolutionize the delivery of healthcare. It supports efforts to significantly improve the quality of healthcare by increasing accessibility and efficiency through reducing the need to travel, providing clinical support, overcoming geographic barriers, offering various types of communication devices, and improving patient outcomes. Thus, given the current focus on efforts to contain costs, improve the delivery of care to all segments of the population, and meet consumer demand, telemedicine is an attractive tool to use for success in these areas.

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The use of telemedicine has been shown to allow for better long-term care management and patient satisfaction; it also offers a new means to locate health information and communicate with practitioners (eg, via e-mail and interactive chats or videoconferences), thereby increasing convenience for the patient and reducing the amount of potential travel required for both physician and patient. Web-based disease management programs encourage clients to assume greater responsibility for their own care, help healthcare providers to treat clients earlier (when they are not as ill), provide local and less expensive services, extend scarce healthcare resources, enhance follow-up care, improve client access to services, and increase the accuracy and quality of patients' medical records.[1]

Telemedicine connects the convenience, low cost, and ready accessibility of health-related information and communication using the Internet and associated technologies. Beginning with the use of telephone consults, telemedicine has become more sophisticated with each advance in technology, and now involves telecommunication and computers to provide healthcare information and services to clients at multiple locations. The application of this tool covers a wide and diverse scope, including: a) online databases and tools to ensure standards of care, b) critical pathways and patient outcomes, c) computer-assisted diagnosis, d) effective drug information and electronic prescription filling, and e) enhanced availability of research data. Clinicians are able to handle more patients than traditional care models would typically allow, and with increased access and a more connected level of care, physicians and patients can work

together to achieve their therapeutic goals, particularly in the home and hospice care environments.[2,3]

This paper presents a critical review of the prevailing literature on telemedicine.

METHODS

A literature review was established by utilizing databases accessible through the Health Professions Divisions Library at Nova Southeastern University. The following databases were used to search for the sources for this project and identify current research on telemedicine: Citations and Abstracts for Literature of Nursing and Allied Health (CINHAL) plus full text, Cochrane Library, EBSCO host, and OVID. Key search phrases used in the scan included "telemedicine" and "telehealth," which produced 6563 and 4482 results, respectively. To narrow study selection, Boolean strings were considered for the literature search, with "AND" used with the advanced search pairings, such as "telemedicine AND nursing" and "telehealth AND nursing." Sources from the last 10 years were considered for inclusion in the review of literature. The subsequent search generated 119 and 272 results, respectively. The abstracts were reviewed and 18 articles were chosen based on their consistencies surrounding the investigation of telemedicine.

RESULTS

Clinical Applications of Telemedicine

There are 4 clinical applications of telemedicine: 1) real-time interactive mode, 2) store-and-forward mode, 3) remote monitoring, and 4) communication via telephone.[4] Telephone communication the most basic type of telemedicine that provides communication and remote care delivery. In real-time telemedicine, a link between the involved individuals allows a real-time interaction to take place, but requires sending patient data from one site to a remote location, with an expert available to evaluate the data. These real-time encounters use a specially equipped personal computer with a telephone line hook-up to allow people to meet face-to-face and/or view papers and images simultaneously, even though they are not in the same location. Videoconferencing is one example of this type of application.[4] Store and forward ensures that all information, including digital images, video, audio, and data, is captured, stored, and sent electronically to a specialist or clinician at another facility for interpretation and feedback.[4] In remote monitoring, devices intelligently acknowledge the patient, record any abnormalities, and transmit data. For example, a cardiac event monitoring device allows patients to record arrhythmia whenever they experience dyspnea, angina, palpitations, or unexplained syncope. They can transmit the data over the phone and the ordering physician is notified immediately in the event of an abnormal rhythm. The benefits of this type of technology allow clinicians to cut travel time without decreasing client contact. In addition, telemedicine services eliminate the need for visas for international patients.[1]

Benefits of Telemedicine

Using telemedicine technology to remotely monitor health, such as through the use of smart surveillance cameras and analytical software, can be used with elderly clients to notify their caregivers of changes in activity, falls, or lack of movement. This type of care can reduce costs, potentially keep these older individuals in their own homes longer, and help physicians to more easily tailor treatment according to a patient's choices and availability of services.[5] This is particularly important as the 65-years-and-older population explodes without a concomitant increase in funds for healthcare services. It is estimated that by 2030, individuals 65 years or older will represent 20% of the US population. Therefore, Medicare and Social Security programs will face financial challenges as the ratio of individuals paying taxes to retirees receiving benefits will drastically diminish.[3]

Use of telemedicine also has the potential to help patients become more involved in their healthcare plan and increase their autonomy.[3] Patients who require wound care are another population that can be managed well at home through telemedicine applications. For instance, telemedicine facilitates communication among: a) a tissue viability nurse at a patient's home who evaluates the patient's condition via wound description and photographs that are entered into the database, b) another tissue viability nurse working in an outpatient clinic at a different hospital, and c) a physician who is highly interested in wound care working in a different healthcare facility.[6]

A Web-based solution for care coordination can integrate information from biometric measures and diagnostic tests and automatically alert clinician of panic values. As an example, "Health Buddy," an in-home communication device, can be used to provide heart failure disease management,[7] with biometric measurements (eg, heart rate and pattern, blood pressure, respiratory rate, fetal heart rate) able to be monitored at another site. Women with high-risk pregnancies, individuals with diabetes, and cardiac and postoperative patients can also be monitored at home. The device prompts the appropriate patients to take their medicine and keep their legs elevated when sitting and monitors subjective reports of difficulty breathing or increased edema. On the other end of the connection, nurses receive alerts when problems are indicated.

Legal and Privacy Issues/Resolutions

Liability

Telemedicine is plagued by a number of liability concerns.[8] First, there is the possibility that a patient may perceive it as inferior because the consulting professional does not perform a hands-on examination. Therefore, the distant provider, who has not personally examined the patient and may be relying on another presenter, might not be able to render a fully informed opinion or could end up with results that are inaccurate, incomplete, or misleading. Major issues include questions of liability when information provided over the telephone is misinterpreted.[1]

Reimbursement and Licensure

These 2 items represent major barriers to the growth and practice of telemedicine and need to be addressed in the context of technology-enhanced interventions.[9] There have been incidents in which practitioners were eligible for reimbursement of the costs associated with telemedicine services and problems with how they are paid. Further, although healthcare professionals are only licensed to practice within certain jurisdictions, telemedicine requires multiprovince licensure, both for their primary province and for the jurisdiction in which services are rendered. Applications for licensure in different provinces can be lengthy and expensive, with the ultimate result being restricting access to services. There are different practice provisions across the country, and the uncertainties related to licensure may be subject to malpractice lawsuits and questions about how that liability might be distributed, which will continue to hamper access to telemedicine.[1]

Privacy and Confidentiality

Telemedicine should not create greater concerns about or risks to medical record privacy than any other form of consultations—in the United States, it is subject to Health Insurance Portability and Accountability Act (HIPAA) regulations.[1] Although patients require continuous support and education, the privacy, security, and confidentiality of their data must be maintained at all times. Only authorized users—those who are directly involved in the ongoing care and treatment of a patient—and those having a legal right and clear need to approach the systems where the information resides have access to this information. This restricted access increases patient safety and reduces anxiety regarding misuse and availability of personal information. Maintaining the privacy and confidentiality of telemedicine services is crucial to acceptance by consumers and healthcare professionals; these providers must adhere to all data privacy and confidentiality guidelines.[4] Nurses and other healthcare professionals need to be mindful of these issues, especially when technicians not bound by professional codes of ethics are present at telemedicine sessions.[1]

Security

Protection of information and computer systems should receive top priority. Security mechanisms use a combination of logical and physical restrictions to provide a greater level of protection, including firewalls and antivirus and other software that detects malicious programs and spyware. An example of a logical restriction is automatic sign-off; the operating system should lock down after a specified period of inactivity.[1] In addition, the constant creation of new viruses makes it necessary to update antivirus software often. These measures should be reevaluated periodically to determine what modifications need to be made.

Information security training and education are important components in fostering proper system use. Most problems with information system security are primarily related to the human factor rather than the technical one. Support staff should be capable, flexible, and experienced. Technical support staff who are present during the exchange of client information need to be aware of institutional policies, procedures, and laws (such as HIPAA) that are designed to protect client privacy. These individuals should sign the same sort of statement that clinical personnel sign on when receiving their information system access code. In the case of home monitoring, support is crucial to help participants feel comfortable with the technology, particularly when using the internet and Web applications.[10]

Additionally, secure modems and encryption are particularly useful in conjunction with remote access. System security involves protection against deliberate attacks, errors, omissions, and disasters. Good system management is a key component of a strong security framework because it encompasses monitoring, maintenance, operations, traffic management, supervision, and risk management. Greater awareness, sufficient resources, and an organization-wide commitment to information security are needed.[1]

Quality

Speed and access to information at any time, from any place, are essential to maintaining a high quality of service; slowdowns or outages in service are not acceptable.[1] Descriptions of some telemedicine applications describe inadequate funding to establish and maintain the technological infrastructure needed.[11] In certain cases, nurses are responsible for the set-up and basic support of telemedicine devices. Although the wisdom of this approach may be questioned in light of the limited availability of nurses, it can be used as an opportunity to establish rapport and comfort with the technology.[12] Equipment capable of transmitting and receiving diagnostic-grade images can be cost-prohibitive—although costs are declining—but it is significantly less costly than that of an inpatient admission.

There are 2 other major issues surrounding the quality of telemedicine services. The first is that services must be at least of the same quality as traditional services, particularly for reimbursement services. The second is the paradox that geographically isolated populations stand to derive the largest benefits from telemedicine although they have limited access to traditional healthcare services and often have the poorest infrastructure, resources, and capability to support telemedicine.[13] Telemedicine visits can require extra time for equipment management and transmittal of prescriptions.[14] There is also a need for extensive research to establish effectiveness and cost and quality relationships.[15]

Other Barriers to Telemedicine

Despite its advocates, many healthcare professionals have been slow to accept the application of telemedicine.[16] Some are simply resistant to change unless they see the potential benefits, while other reasons include the perception that telemedicine applications are not indicative of "real" nursing—this may stem from liability concerns and discomfort over not seeing a client face-to-face—and that telemed-

icine applications will eventually reduce the number of healthcare professionals needed and they fear job loss as more clients can be treated at home.

There are threats to patient safety when telemedicine applications fail to render the same level of care as hands-on care or when problems occur with the use of electrical devices.[1] There is also lack of acceptance by users that may arise from discomfort with technology, the relationship with the provider, and concerns over security of information and confidentiality. It is essential to educate the clients and increase public awareness. Healthcare professionals need to hold free information sessions for patients who are interested in more comprehensive information to aid them in making an informed decision and to promote a better understanding of such technology.

Most discussions of telemedicine include the electronic health record as the primary means to make client data readily available and store diagnostic images. Picture Archiving Communications Systems (PACS) permit remote access to diagnostic images at times that are convenient to physicians. Health personnel need to shape the development of technological standards by determining the adequate image quality for diagnosis. Unfortunately, there has been insufficient funding for further development of PACS technology.[17]

Strategies to Establish a Telemedicine Plan

Successful establishment and implementation of a telemedicine plan requires strategic planning and consideration of: a) necessary infrastructure, b) costs and reimbursement, c) human factors, and d) equipment and technology issues. In terms of infrastructure, it is essential to address how telecommunication breakdowns will be handled: will backup be provided? What happens when a power outage in the home severs a link? Technical support must be available to resolve any problems that might arise.[1] Additionally, the individuals who will use the system should be involved in its design from the beginning to ensure its effectiveness and uptake. Specific competencies that must be addressed include training time to develop the technical skills needed to set up and use equipment, professional knowledge, interpersonal skills, documentation, professional development, resource management, practice and administrative issues, and security of healthcare information.[1] Time is needed for healthcare providers to get accustomed to telemedicine practices; an example of this may be seen in teleradiology, where radiologists must learn how to interpret images using a monitor.[17]

Future Directions

Converged devices, such as smartphones, combine the utility of cell phones and personal digital assistants, allowing users to monitor telemetry patients while performing other tasks. These devices provide the potential to increase patient safety, facilitate communication among healthcare professionals, and reduce liability (because orders can be clearly viewed), thus eliminating the errors associated with poor handwriting or verbal instructions.[18]

The model of "connected health"—a new paradigm of care—promises to reduce costs and improve quality by working with clients proactively. Individuals monitor their own health, which results in fewer visits to physicians and inpatient hospital stays.[19] The demand for telemedicine services is expected to grow exponentially as baby boomers age, and home-based care will likely continue its exponential growth as a means to help keep older patients in their own homes and better manage their conditions. Demands for quality, patient safety, and more options will help change the reimbursement picture and open the door for more telemedicine applications, new technologies will emerge to meet this need, and the use of existing measures, such as biometric authentication, will become more common.

DISCUSSION

Telemedicine significantly contributes to the provision of healthcare in underserved areas through services such as telestroke, telecardiology, teledermatology, telepediatrics, telepsychiatry, and teleneonatology care. This tool aims to improve access to care for anyone regardless of their location[20] and has the potential to reduce the number of face-to-face visits. Additionally, it can help improve the organization of the health record with automatic collection of data and better coordination of care among clinicians in various locations.

In telecardiology—the transmission of cardiac diagnostic tests in conjunction with electronic stethoscope examinations for second opinions by cardiologists at another site—there may be a reduction in the need for a patient to travel by allowing the specialist to perform an assessment remotely using a digital Bluetooth stethoscope and existing telemedicine equipment. Another example is telestroke, which enhances on-demand emergency acute stroke care by using videoconferencing to connect neurologists with emergency departments at facilities without neurologists on site. With telestroke, neurologists can communicate directly with the patient and family during assessment, discuss the treatment plan with all involved, and provide comprehensive and coordinated acute stroke care. Reducing the time to receive treatment is critical in improving patient recovery.

During the telemedicine implementation phase, providing support to facilitate transition and communicate accuracy and availability of the electronic system is very important. There is a need to provide continuing education and develop a communication plan, with useful tools like newsletters and posters, to increase awareness of telemedicine and later expand its capability. To promote adoption, a change management plan must be structured in conjunction with the telemedicine implementation design. It is essential to incorporate change agents into the program that will help implementers and users to effectively and meaningfully communicate with each other in order to address any gaps that may exist. The change agents provide education sessions related to the importance of change that are key to having healthcare providers open their minds to change and adapt the system to existing practices.

Change management provides invaluable assistance to healthcare organizations to better manage their resources and improve productivity through the use of continuous positive reinforcement and involvement of supporting resources. They will be able to troubleshoot, and their inputs for change will act as catalysts to get their active involvement in setting up new environment. Timely and ongoing training will allow healthcare educators, providers, and agencies to examine information trends and react to changes proactively. As new rules emerge and technology changes, all organizational members need to participate in the use of telemedicine to ensure wide acceptance.[2,4]

CONCLUSIONS

Among other benefits, the use of telemedicine improves follow-up care, ensures patient access to services, and allows providers to treat patients at home and in remote areas. Some telemedicine applications include diagnostic evaluation, decision making, storage and dissemination of records, and education of healthcare professionals. Several factors are essential to establishing and using a telemedicine link: implementers should develop a plan that addresses areas such as compliance with standards, technical requirements, reimbursement, human factor considerations, and strategies to handle telecommunication breakdowns and how to deal with equipment malfunctions.

Author Affiliations: Department of Health Science, Nova Southeastern University, Fort Lauderdale, FL
Send Correspondence to: Maryam Alvandi, DHS, Nova Southeastern University, Fort Lauderdale, FL 33329. E-mail: malvandi@yahoo.com.

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