Telemedicine

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LEARNING OBJECTIVES

1. Differentiate between telehealth and telemedicine and provide examples for each.
2. List the various types of telemedicine consultations.
3. Describe the historical development of telemedicine.
4. Identify the different means of transferring information with telemedicine, such as store and forward and real time.
5. List the potential benefits of telemedicine to patients and clinicians.
6. Discuss the most significant ongoing telemedicine projects.

ABBREVIATIONS: WHO - World Health Organization, NASA - National Aeronautics and Space Administration, ECG – Electrocardiogram, ICU - Intensive Care Unit

INDEX TERMS: Telehealth, Telemedicine, Store and Forward Telemedicine, Asynchronous Telemedicine, Real-Time Telemedicine, Synchronous Telemedicine, Patient Confidentiality

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INTRODUCTION

Telehealth is a broad umbrella that covers the technologies that provide clinical and administrative support for patients and physicians. The Office of the Advancement of Telehealth defines telehealth as the support provided for long distance clinical healthcare, patient and professional health-related education and public health and health administration by the use of electronic information and telecommunication technologies.[1-2] Examples of telehealth include non-clinical services comprising administrative meetings, provider training and continuing medical education along with clinical services. Other examples of telehealth also include live-interactive videoconferencing, remote monitoring, and store-and-forward imaging.[3]

Telemedicine, on the other hand, refers to the remote delivery of clinical care through electronic communications. The term was coined in the 1970s by the World Health Organization (WHO) as a mode of valid exchange of medical information pertaining to diagnosis, treatment and prevention of disease and injuries via information and communication technologies with the goal of improving patients' health status. Telemedicine cannot be considered a separate medical specialty; on the contrary, it is considered a tool to be used by healthcare providers to disseminate the traditional medical practice beyond the walls of the typical medical practice.[4-5] Telemedicine has continued to broaden as more specialties are able to use this approach and the technology itself becomes more pervasive and affordable. Telemedicine applications and services include email, two-way video, wireless tools, smart phones and other communication technology tools.[8] Examples of telemedicine include group therapy, nursing interactions, education and training, televisits to community health workers, and medical image transmission. This also includes teleconsultations such as teleradiology, teledermatology, teleneurology and telepharmacy.[6-7]

In summary, telehealth is a means of integration of telecommunication systems into the practice of protecting and promoting health, while telemedicine is

the incorporation of these systems into curative medicine. Telehealth is a wider range of remote healthcare services that are not necessarily related to the clinical field which is called remote non clinical services such as training, medical education and administrative gathering while telemedicine is part of the remote services that is related to the clinical field.[6] The telemedicine application could be in different categories such as patient care, professional education, patient education, research, public health and healthcare administration.[7-8]

Definition and History of Telemedicine

The idea of telemedicine is not new. Medical information has been transmitted between distant parties for a long time. For example, bubonic plague information was exchanged in Europe using heliograph or bonfires. Moreover, lists of casualties during the Civil War were sent using telegraph along with orders of medical supplies. The telephone, when introduced in the 1900s, became the major tool of communication especially in the medical field. In 1930, radio was used for transferring medical information, particularly in remote areas like Alaska and Australia. However, the exact time of using telecommunication in health field remains unknown.[9] The word "telemedicine" was originated in 1965-1970. The Greek prefix "tele" or "telo" or "tel" means “distant,” particularly “transmission over a distance”.[9]

It is believed the first true use of the term telemedicine was when physicians on earth successfully monitored the health of astronauts in space. Advanced biomedical telemetry and telecommunications systems developed by the National Aeronautics and Space Administration (NASA) were used. NASA scientists remotely monitored astronauts' physiological functions such as blood pressure, heart rate, respiration rate, and temperature.[10]

The invention of television in the 1950s promoted telemedicine in an indirect way. In 1964, the first practical medical use of video communication was completed between the Norfolk State Hospital and the Nebraska Psychiatric Institute in Omaha. In 1967, a medical station at Boston's Logan Airport was linked to Massachusetts General Hospital.[9]

Since then, many initiatives and programs continued to evolve, especially the ones that can link rural areas to health facilities. In addition, rapid advancements in communication technologies contributed greatly to the spread and development of current telemedicine.

Categories of Telemedicine

Telemedicine can be divided into two main categories: store and forward telemedicine and real-time telemedicine. Store and forward telemedicine, also known as asynchronous telemedicine, does not require the communicating sides to be on contact at the same time of data exchange. Data can be collected, organized, and stored. When feasible, the data are sent to the intended destination for diagnosis or analysis. An example is when photographs of skin lesion or ECG are sent via email along with patient's information and history to a health professional in the related field working in another or remote health facility.[11] Real time telemedicine, or synchronous telemedicine, differs in that it requires both the health professional practitioner and the patient to be in contact at the same time. Synchronous telemedicine is considered interactive and live, which includes videoconference aided by tools for audio and visual examination. Devices for remote physical examination, such as electronic stethoscopes, can be used.[11]

Services of Telemedicine

There are variable services for telemedicine. Primary care and specialist referral services can be used for achieving medical care. Either the patient can see the specialist via live video or the specialist can receive the patient's data at a later time. In both cases, a general practitioner or a primary care health professional is examining a patient while getting help from the specialist.[5,8] Remote patient monitoring is another example. It includes the use of tools and devices that can collect vital information about the patient such as weight, ECG, or blood sugar. Data can then be sent remotely to the health facility for analysis. Such service is of great benefit for patients at home who receive tele-care and it can be combined with nurses' visits. Consumer medical and health information service is mainly for consumers to get accurate health information. Internet or wireless instruments can be used as well as online conversations between health professionals for help. Lastly, medical education could

be viewed as a service directed for health professionals rather than patients. Telecommunication means can be used for continuing medical education credits for health professionals.

Delivery Mechanisms

Medical information needs a mode of transmission to be delivered for the receiving side. According to the American Telemedicine Association there are four mechanisms of medical information delivery: network programs, point-to-point connections, monitoring center links, and web-based e-health patient service sites.

Networked programs allow remote health facilities to be connected to tertiary care hospitals along with rural public health centers and others in suburban areas. The connections are performed using the Internet or devoted high-speed lines for telecommunication. The American Telemedicine Association estimated the existing number of telemedicine networks in the United States to be around 200 networks linking about 3000 sites.

Hospitals and clinics that provide direct or outsource services to independent medical service suppliers are using private high speed networks. Point-to-point connections are used in services like stroke assessment, intensive care services, radiology, and mental health services.

Monitoring center links are mainly used for patients who are provided healthcare at home. Diseases monitored using these services are related to pulmonary, cardiac, or fetal disorders. A number of monitoring systems use the Internet; however, normal land-lines or wireless connections are often used to communicate directly between the patient and the health clinic. With web-based e-health patient service sites, the internet is used to provide direct customer request of information and service. Websites delivering direct patient care are also included under this service.

Benefits of Telemedicine

Like any other new modern service telemedicine has been a step forward towards a better overall medical service. Noticing the rapid spread of telemedicine, the benefits have definitely contributed. Telemedicine shortens the distances and saves time through bringing healthcare services in reach of patients. Not only do patients benefit from telemedicine services, physicians and health providers can reach patients and colleagues in distant areas with no time. Furthermore, telemedicine reduces the cost and inconvenience of traveling. The hospital's length of stay for patients is reduced and chronic disease managements are improved due to the use of telemedicine. Telemedicine provides care up to the level of conventional healthcare, even better in some specialties like mental health and ICU care.[5,8] In light of all telemedicine benefits for both patients and healthcare providers, the demand for telemedicine is increasing. Studies conducted in the past fifteen years prove the spread of telemedicine combined with increased patient satisfaction.[8]

Legal and Ethical Concerns

The rapid spread and adoption of telemedicine may create more modern technology related challenges. If remained unsolved, these challenges may become an obstacle in the way telemedicine can be utilized. Problems related to telemedicine may range from technical limiting barriers to ethical and confidentiality concerns. Technical limitations can be overcome by advancement in technology. However, ethical and legal concerns remain an obstacle needs attention. In order for a physician to conduct a successful session remotely with a patient and reach an accurate diagnosis, he/she needs sufficient medical information and history about the patient. Whether such information is conveyed to the physician correctly is a concern; also, whether the information is transferred securely is another critical concern. Patient confidentiality and consent must be taken into account when dealing with telecommunication technology. The storage of patients' personal information and access to it should be known, documented, and approved.[13]

In the conventional way of seeing a healthcare practitioner, the patient remains the responsibility of that particular referring physician, even when another clinician is consulted for advice. Normally, both clinicians will be in same country and following the same rules. Nevertheless, when a referring physician is consulting another using telemedicine a cross borders, which rules shall be applied? Another matter is raised in cross border practice regarding licensure. It needs to be

determined whether the consulted physician from another country needs to have a licensure from the country of the patient or not.[11]

CONCLUSION

Telemedicine is a fascinating new development that enhances the level of medical and health services in general. Despite the rapid development and spread in telemedicine, more is still expected, especially in terms of providing service for countries in the developing world. Certain clear regulations and general policies and guidelines need to be established and internationalized to solve issues bounding the spread of telemedicine and concerning societies.

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