Telemedicine

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See also: List of video telecommunication services and product brands

Telemedicine is a rapidly developing application of clinical medicine, where medical information is transferred through interactive audiovisual media for the purpose of consulting. Telemedicine can also be used to conduct examinations and remote medical procedures.[*citation needed*]

Telemedicine may be as simple as two health professionals discussing a case over the telephone, or as complex as using satellite technology and videoconferencing equipment to conduct a real-time consultation between medical specialists in two different countries. Telemedicine generally refers to the use of telecommunication and information technologies for the delivery of clinical care.[*citation needed*]

The terms eHealth and telehealth are at times incorrectly interchanged with telemedicine. Like the terms "medicine" and "health care", telemedicine often refers only to the provision of clinical services while the term telehealth can refer to clinical and non-clinical services such as medical education, administration, and research. The term eHealth is often used, particularly in the U.K. and Europe, as an umbrella term that includes telehealth, electronic medical records, and other components of health IT.

Contents

Early precursors

Care at a distance (also called *in absentia* care) is an old practice which was often conducted via post. There has been a long and successful history of in absentia health care which, thanks to modern communication technology, has evolved into what we know as modern telemedicine.[*citation needed*]

In its early manifestations, African villagers used smoke signals to warn people to stay away from the village in case of serious disease. In the early 1900s, people living in remote areas of Australia used two-way radios, powered by a dynamo driven by a set of bicycle pedals, to communicate with the Royal Flying Doctor Service of Australia.

Types of telemedicine

Telemedicine can be broken into three main categories: **store-and-forward**, **remote monitoring** and **interactive** services.

Store-and-forward telemedicine involves acquiring medical data (like medical images, biosignals etc.) and then transmitting this data to a doctor or medical specialist at a convenient time for assessment offline. It does not require the presence of both parties at the same time. Dermatology (cf: teledermatology), radiology, and pathology are common specialties that are conducive to asynchronous telemedicine. A properly structured medical record preferably in electronic form should be a component of this transfer. A key difference between traditional in-person patient meetings and telemedicine encounters is the omission of an actual physical examination and history. The 'store-and-forward' process requires the clinician to rely on a history report and audio/video information in lieu of a physical examination.

Remote monitoring, also known as self-monitoring or testing, enables medical professionals to monitor a patient remotely using various technological devices. This method is primarily used for managing chronic diseases or specific conditions, such as heart disease, diabetes mellitus, or asthma. These services can provide comparable health outcomes to traditional in-person patient encounters, supply greater satisfaction to patients, and may be cost-effective.

Interactive telemedicine services provide real-time interactions between patient and provider, to include phone conversations, online communication and home visits. Many activities such as history review, physical examination, psychiatric evaluations and ophthalmology assessments can be conducted comparably to those done in traditional face-to-face visits. In addition, “clinician-interactive” telemedicine services may be less costly than in-person clinical visit

Emergencies Telemedicine

The most common Emergency Telemand current daily Telemedecine is done by SAMU's Regulator Physician in the word like in France ,Spain, Chile, Brazil. Onboard aircraft or maritime emergency telemedecine is also current in Paris Lisbon Toulouse Samus.

Benefits and uses

Telemedicine can be extremely beneficial for people living in isolated communities and remote regions and is currently being applied in virtually all medical domains. Patients who live in such areas can be seen by a doctor or specialist, who can provide an accurate and complete examination, while the patient may not have to travel or wait the normal distances or times like those from conventional hospital or GP visits. Recent developments in mobile collaboration technology with the use of hand-held mobile devices allow healthcare professionals in multiple locations the ability to view, discuss and assess patient issues as if they were in the same room.[1]

Telemedicine can be used as a teaching tool, by which experienced medical staff can observe, show and instruct medical staff in another location, more effective or faster examination techniques. It improved access to healthcare for patients in remote locations. "Telemedicine has been shown to reduce the cost of healthcare and increase efficiency through better management of chronic diseases,shared health professional staffing, reduced travel times, and fewer or shorter hospital stays." Several studies have documented increase patient satisfaction of telemedicine over past fifteen years.[2]

The first interactive telemedicine system, operating over standard telephone lines, for remotely diagnosing and treating patients requiring cardiac resuscitation (defibrillation) was developed and marketed by MedPhone Corporation Telemonitoring is a medical practice that involves remotely monitoring patients who are not at the same location as the health care provider. In general, a patient will have a number of monitoring devices at home, and the results of these devices will be transmitted via telephone to the health care provider. Telemonitoring is a convenient way for patients to avoid travel and to perform some of the more basic work of healthcare for themselves.

In addition to objective technological monitoring, most telemonitoring programs include subjective questioning regarding the patient's health and comfort. This questioning can take place automatically over the phone, or telemonitoring software can help keep the patient in touch with the health care provider. The provider can then make decisions about the patient's treatment based on a combination of subjective and objective information similar to what would be revealed during an on-site appointment.

Some of the more common things that telemonitoring devices keep track of include blood pressure, heart rate, weight, blood glucose, and hemoglobin. Telemonitoring is capable of providing information about any vital signs, as long as the

patient has the necessary monitoring equipment at his or her location. Depending on the severity of the patient's condition, the provider may check these statistics on a daily or weekly basis to determine the best course of treatment.

Cardiac MonitorRemote Patient MonitoringVital Signs MonitorTelemedicine SystemPortable Heart MonitorHolter MonitorPortable Ekg Monitor in 1989 under the leadership of its president and founder, S.Eric Wachtel. A year later the company introduced a mobile cellular version, the MDphone. Twelve hospitals in the U.S. served as receiving and treatment centers.[3]

The first Ayurvedic telemedicine center was established in India in 2007 by Partap Chauhan, a well-known Indian Ayurvedic doctor.

Monitoring a patient at home using known devices like blood pressure monitors and transferring the information to a caregiver is a fast growing emerging service. These remote monitoring solutions have a focus on current high morbidity chronic diseases and are mainly deployed for the First World. In developing countries a new way of practicing telemedicine is emerging better known as Primary Remote Diagnostic Visits, whereby a doctor uses devices to remotely examine and treat a patient. This new technology and principle of practicing medicine holds significant promise of improving on major health care delivery problems, in for instance, Southern Africa, because Primary Remote Diagnostic Consultations not only monitors an already diagnosed chronic disease, but has the promise to diagnose and manage the diseases a patient will typically visit a general practitioner for.

Delivery of specialist care

Telemedicine can facilitate specialty care delivered by primary care physicians according to a controlled study of the treatment of hepatitis C.[4]

Telecardiology

ECGs, or electrocardiographs, can be transmitted using telephone and wireless. Willem Einthoven, the inventor of the ECG, actually did tests with transmission of ECG via telephone lines. This was because the hospital did not allow him to move patients outside the hospital to his laboratory for testing of his new device. In 1906 Einthoven came up with a way to transmit the data from the hospital directly to his lab.[5]

Teletransmission of ECG using indigenous methods

One of the oldest known telecardiology systems for teletransmissions of ECGs was established in Gwalior, India in 1975 at GR Medical college by Dr. Ajai Shanker, Dr. S. Makhija, P.K. Mantri using an indegenous technique for the first time in India.

This system enabled wireless transmission of ECG from the moving ICU van or the patients home to the central station in ICU of the department of Medicine. Transmission using wireless was done using frequency modulation which eliminated noise. Transmission was also done through telephone lines. The ECG output was connected to the telephone input using a modulator which converted ECG into high frequency sound. At the other end a demodulator reconverted the sound into ECG with a good gain accuracy. The ECG was converted to sound waves with a frequency varying from 500 Hz to 2500 Hz with 1500 Hz at baseline.

This system was also used to monitor patients with pacemakers in remote areas. The central control unit at the ICU was able to correctly interpret arrhythmia. This technique helped medical aid reach in remote areas.[6]

In addition, electronic stethoscopes can be used as recording devices, which is helpful for purposes of telecardiology.

In Pakistan three pilot projects in telemedicine was initiated by the Ministry of IT & Telecom, Government of Pakistan (MoIT) through the Electronic Government Directorate in collaboration with Oratier Technologies (a pioneer company within Pakistan dealing with healthcare and HMIS) and PakDataCom (a bandwidth provider). Three hub stations through were linked via the Pak Sat-I communications satellite, and four districts were linked with another hub. A 312 Kb link was also established with remote sites and 1 Mbit/s bandwidth was provided at each hub. Three hubs were

established: the Mayo Hospital (the largest hospital in Asia), JPMC Karachi and Holy Family Rawalpindi. These 12 remote sites were connected and on average of 1,500 patients being treated per month per hub. The project was still running smoothly after two years.[7]

Telepsychiatry

Telepsychiatry, another aspect of telemedicine, also utilizes videoconferencing for patients residing in underserved areas to access psychiatric services. It offers wide range of services to the patients and providers, such as consultation between the psychiatrists, educational clinical program, diagnosis and assessment, medication therapy management, etc.

The following are some of the model programs and projects which are undergoing for implementation of telepsychiatry in rural areas in the US.

1. University of Colorado Health Sciences Center (UCHSC) supports two programs for American Indian and Alaskan Native populations

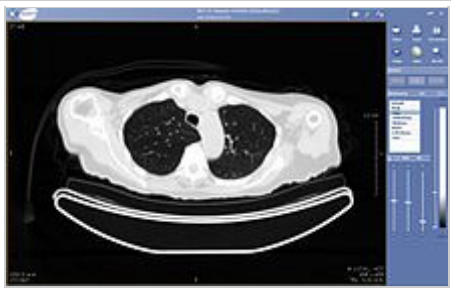
   a. The Center for Native American Telehealth and Tele-education (CNATT) and
   b. Telemental Health Treatment for American Indian Veterans with Posttraumatic Stress Disorder (PTSD)

2. Military Psychiatry, Walter Reed Army Medical Center.

Links for several sites related to telemedicine, telepsychiatry policy, guidelines, and networking are available at the website for the American Psychiatric Association.[8]

Teleradiology

Teleradiology is the ability to send radiographic images (x-rays, CT, MR, PET/CT, SPECT/CT, MG, US...) from one location to another.[9] For this process to be implemented, three essential components are required, an image sending station, a transmission network, and a receiving-image review station. The most typical implementation are two computers connected via the Internet. The computer at the receiving end will need to have a high-quality display screen that has been tested and cleared for clinical purposes. Sometimes the receiving computer will have a printer so that images can be printed for convenience.



A CT exam displayed through teleradiology

The teleradiology process begins at the image sending station. The radiographic image and a modem or other connection are required for this first step. The image is scanned and then sent via the network connection to the receiving computer.

Today's high-speed broadband based Internet enables the use of new technologies for teleradiology : the image reviewer can now have access to distant servers in order to view an exam. Therefore, they do not need particular workstations to view the images ; a standard Personal Computer (PC) and Digital Subscriber Line (DSL) connection is enough to reach keosys central server. No particular software is necessary on the PC and the images can be reached from wherever in the world.

Teleradiology is the most popular use for telemedicine and accounts for at least 50% of all telemedicine usage.

Telepharmacy

Telepharmacy is another growing trend for providing pharmaceutical care to the patients at remote locations where they may not have physical contact with pharmacists. It encompasses drug therapy monitoring, patient counseling, prior authorization, refill authorization, monitoring formulary compliance with the aid of teleconferencing or

videoconferencing. In addition, video-conferencing is vastly utilized in pharmacy for other purposes, such as providing education, training, and performing several management functions.[10]

A notable telepharmacy program in the United States conducted at a federally qualified community health center, Community Health Association of Spokane (CHAS) in 2001, which allowed the low cost medication dispensing under federal government's program. This program utilized videotelephony for dispensing medication and patient counseling at six urban and rural clinics. There were one base pharmacy and five remote clinics in several areas of Spokane, Washington under the telepharmacy program at CHAS. "The base pharmacy provided traditional pharmacy study to the clients at Valley clinic and served as the hub pharmacy for the other remote clinics."

The remote site dispensing and patient education process was described as follows: once the prescription is sent from the remote clinics to the base pharmacy, the pharmacist verifies the hard copy and enters the order. The label is also generated simultaneously, and the label queue is transmitted to the remote site. When the label queue appears on the medication dispensing cabinet known as ADDS, the authorized person can access the medicine from ADDS followed by medication barcode scanning, and the printing and scanning of labels. Once those steps are done, the remote site personnel are connected to the pharmacist at base pharmacy via videoconferencing for medication verification and patient counseling.[11]

In recent time, the U.S. Navy Bureau of Medicine took a significant step in advancing telepharmacy worldwide. The telepharmacy program was piloted in 2006 "in the regions served by Naval Hospital Pensacola, Florida, and Naval Hospital Bremerton, Washington." Starting from March 2010, the Navy expanded its telepharmacy system to more sites throughout the world. According to Navy Lieutenant Justin Eubanks at Navy Hospital Pensacola, Florida, telepharmacy would be initiated at more than 100 Navy sites covering four continents by the end of 2010.[12]

U.S. licensing and regulatory issues

Restrictive licensure laws in the United States require a practitioner to obtain a full license to deliver telemedicine care across state lines. Typically, states with restrictive licensure laws also have several exceptions (varying from state to state) that may release an out-of-state practitioner from the additional burden of obtaining such a license. A number of States require practitioners who seek compensation to frequently deliver interstate care to acquire a full license.

If a practitioner serves several states, obtaining this license in each state could be an expensive and time-consuming proposition. Even if the practitioner never practices medicine face-to-face with a patient in another state, he/she still must meet a variety of other individual state requirements, including paying substantial licensure fees, passing additional oral and written examinations, and traveling for interviews.

Regulations concerning the practice of Telemedicine (http://www.medlicense.com/telemedicine_license.html) vary from state to state.[13] Physicians who will be prescribing over the Internet to patients should mandate strict controls on their practice to insure that they stay compliant with the various State Medical Board Regulations concerning Internet Prescribing.[14]

See also

- American Telemedicine Association
- eHealth
- List of video telecommunication services and product brands
- Medical device
- mHealth
- Mobile collaboration
- National Rural Health Association
- Ontario Telemedicine Network
- Robotic surgery
- Tele-epidemiology

- Teledentistry
- Telehealth
- Telepsychiatry
- Telepathology
- UNESCO Chair in Telemedicine
- Women on Web

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2. ^ What Is Telemedicine? (http://www.americantelemed.org/files/public/abouttelemedicine/What_Is_Telemedicine.pdf)
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13. ^ Information Provided for Physicians: Doctors Seeking a Medical Licensing Service: MedLicense.com Licensing Physicians in all 50 States (http://www.medlicense.com/telemedicine_license.html)
14. ^ MedLicense.com - Practical Advise for Physicians who are involved in Telemedicine (http://www.medlicense.com/telemedicine_advice.html)

Further reading

- Teleneurology and requirements of the european Medical Devices Directive (MDD) (http://www.baaske.net/index.php?id=37&L=1) - Telemedical Systems and regulatory affairs for Europe, by Dipl. Ing. Armin Gärtner
- Telemedicine 101: Telemedicine Coming of Age (http://tie.telemed.org/articles/article.asp?path=telemed101&article=tmcoming_nb_tie96.xml) - Telemedicine 101: Telemedicine Coming of Age, by Nancy Brown
- What is Telemedicine? (http://www.icucare.com/PageFiles/Telemedicine.pdf) - What is Telemedicine?, by Robert Higgs (www.icucare.com)

External links

- Telemedicine and Telehealth (http://www.teladoc.com/) Teladoc.
- Telemedicine Pakistan(TelmedPak) (http://www.telmedpak.com)
- Wiki for telemedicine (ATAwiki) (http://www.ATAwiki.org)
- Agency for Healthcare Research and Quality (AHRQ) -- Telemedicine for the Medicare Population (http://www.ahrq.gov/clinic/epcsums/telemedsum.htm)
- Ontario Telemedicine Network -- Making the Connection for Health (http://www.otn.ca)
- American Telemedicine Association (http://www.americantelemed.org)
- Telemedicine Information Exchange (http://tie.telemed.org)
- Canadian Society of Telehealth (http://www.cst-sct.org)
- TELESYNERGY - Telemedicine at the National Institutes of Health (http://telesynergy.nih.gov)
- Telemedicine History (http://www.depts.ttu.edu/communications/vistas/archive/02-summer/stories/miracle-of-telemedicine.php)
- National Rural Health Association (http://www.nrharural.org)
- International Society for Telemedicine & eHealth (ISfTeH) (http://www.isft.net)
- American Psychiatric Asscoiation (http://www.psych.org/Departments/HSF/UnderservedClearinghouse/Linkeddocuments/telepsychiatry.aspx)

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