ASIAN JOURNAL OF PHARMACEUTICAL AND CLINICAL RESEARCH

INNOVARE ACADEMIC SCIENCES
Knowledge to Innovation

Vol 15, Issue 5, 2022

Online - 2455-3891
Print - 0974-2441

Review Article

TELEMEDICINE: REVISITING THE PAST, PRESENT, AND FUTURE DURING COVID PANDEMIC

KASI VISWANATH[1], RAVISHEKAR N HIREMATH[1]*, PRIYANKA PATEL[2], NARENDER YADAV[3], SHIVI GUPTA[4], TUSHENDRA SINGH RANA[5]

[1]Department of Community Medicine, AFMS, New Delhi, India. [2]Assistant Hospital Administrator, GMERS Medical College and General Hospital, Himmatnagar, Gujarat, India. [3]Department of Radiology, AFMS, New Delhi, India. [4]Department of Medicine, AFMS, New Delhi, India. [5]Department of Aviation Medicine, AFMS, New Delhi. Email: drshekar80@gmail.com

Received: 05 January 2022, Revised and Accepted: 16 March 2022

ABSTRACT

Telemedicine is the utilization of electronic facts to correspond expertise for sustaining healthcare when physical distance part the users. Within the same time frame, patient-related data can be simultaneously get collected for large number of people using remote monitoring. However, there is always a disadvantage if any issue arises due to software and hardware. Thus, computer-based patient monitoring can be problematic at sometimes if we exclusively depend on computer system. There should always be a balance between computer dependency and human intelligence use. Each and every one's life difference can be made by maintaining the balance between the two. Here, in this review article, we discussed the historical perspectives, telemedicine system concepts, telemedicine centers infrastructure, role in diverse spheres, types of telemedicine technology, applications in public health, current initiatives, and finally the success and popularity of telemedicine during COVID-19 pandemic.

Keywords: Telemedicine, Covid, Public Health

 DOI: http://dx.doi.org/10.22159/ajpcr.2022v15i5.44063. Journal homepage: https://innovareacademics.in/journals/index.php/ajpcr

INTRODUCTION

Telemedicine is the utilization of electronic facts to correspond expertise for sustaining healthcare when physical distance part the users [1]. According to the WHO, telemedicine refers to the delivery of health-care services, where distance is a crucial factor, by various health-care experts utilizing information technologies for the exchange of suitable information on evaluation, prevention, diagnosis and treatment of disease, and injuries and continuing medical education of health-care providers, for advancing public health systems."

"Tele" is a Greek word meaning "distance" while "mederi" is a Latin word meaning "to heal." Telemedicine, therefore, had been aptly called "healing by wire." Although telemedicine was considered as "advanced" and "investigational" in the initial phases of its evolution, today, it has become a phenomenal reality. It has expanded its horizons to areas of patient care, education, research, administration, and public health [2]. Globally, people living in rural and far-flung areas make great efforts to access appropriate and quality specialty medical care. Moreover, residents of these areas often have poor accessibility to expert healthcare, primarily because consultant physicians are more likely to be in areas of the concerted urban population. Telemedicine holds the prospective to bridge this distance and aid healthcare in these remote areas [3,4].

TELEMEDICINE: HISTORICAL PERSPECTIVES

The outburst of interest in telemedicine over the past few years makes it to appear as a moderately new use of communications technology, while, the truth is that telemedicine has been already been utilized in some form or the other for over three decades. The initial pillars of support and development for telemedicine have been provided by the National Aeronautics and Space Administration (NASA) [5]. The efforts of NASA began in the early 1960s when, during space missions, physiological parameters could be transmitted from both the spacecraft and the spacesuits [6].

One of the earliest accomplishments of NASA in the field of telemedicine was Space Technology Applied to Rural Papago Advanced Health Care project (1972–1975), through which medical care was delivered to the Papago Indian residents in Arizona. The project was designed to provide healthcare to astronauts in space as well as to general Papago reservation [1]. Following this, in 1971, 26 sites in Alaska were selected by the National Library of Medicine's Lister Hill National Center for Biomedical Communication to see if consistent communication would advance village healthcare. Thereby, Applied Technology Satellite (ATS)-1 was used in 1966 which was the NASA's first series of ATS. The primary aim was to explore the use of satellite video consultation to improve the quality of rural healthcare in Alaska [7]. Ever since 1977, the Telemedicine Centre at the Memorial University of Newfoundland has worked toward emerging interactive communication networks for educational programs and medical information diffusion [1]. The North-west Telemedicine Project (1984) of Australia was developed to pilot-test the Q-Network, a government satellite communications system [1]. The project was meant to provide healthcare to five remote towns of the Gulf of Carpentaria. Subsequently, in 1989, NASA conducted its very first international telemedicine program, Space Bridge to Armenia. Under this program on space biology, telemedicine discussions were conducted through one-way video, voice, and facsimile technologies between a medical center in Yerevan, Armenia, and four medical centers in the US [7].

TELEMEDICINE SYSTEM: CONCEPTS

The basic system of telemedicine consists of a communication channel connecting the two different locations and an interface using software and hardware for exchange of information and details so as to provide constant dependency between the two. The telemedicine consulting center is the site where the patient is present with equipment for converting, transforming, and communicating the patient's medical data. On the other hand, a telemedicine specialty center is a site, from where the specialist can interact with the patient present in the remote site view his reports and monitor his progress [8-11].

Telemedicine system hardware consists of a computer, printer, scanner, videoconferencing equipment, etc. The software enables the acquisition of patient information (images, laboratory reports, and films), while,

the communication channel enables the connectivity between two locations [12].

TELEMEDICINE CENTERS: INFRASTRUCTURE

The telemedicine centers can be broadly classified into the following classes: Primary Telemedicine Center (PTC), Secondary Telemedicine Center (STC), and Tertiary Telemedicine Center (TTC). PTCs would be based in primary health settings, STCs in Secondary Medical Centers, and TTCs in tertiary medical settings [8].

In developing countries, where resources are very less and public health problems are more, telemedicine might not be an effective replacement of physicians. Hence, as of now, it might be a poor decision to replace the doctors with telemedicine technology at least for rural area. At the same, in most developed countries, it is always an additional boon for the existing health-care infrastructure.

TELEMEDICINE TECHNOLOGY TOOLS

To carry out all the required functions, majorly, two types of telemedicine tools are present. The first, called "store and forward," is used to transmit digital images from one site to another. In this, a digital image (taken by a digital camera) is "stored" and then sent ("forwarded") by a computer to another location. This is typically used in non-emergency situations, where a diagnosis or consultation may be made in the next 1–2 days and sent back. Teleradiology, telepathology, and teledermatology are a few examples [10].

The other commonly used technology, the two-way interactive television, is utilized when a "face-to-face" conference is necessary. The patient, their service provider, or a telemedicine coordinator (or a combination of any of the three), are at the initial site. The specialist is at the referral site (mostly an urban specialist setting). Videoconferencing tools at both sites allow a "real-time" discussion to take place. Medical specialties such as psychiatry, internal medicine, neurology, cardiology, dermatology, pediatrics and obstetrics, and gynecology are favorable to this kind of consultation [11].

Telemedicine technologies in use today

When setting up a telemedicine network, a suitable bandwidth is very critical. Bandwidth is the ability that predicts how promptly bits of data may be sent down the pathways of a telecommunication channel [12]. The following telemedicine tools are currently in use today:

Integrated services digital network (ISDN)

ISDN is a dial-up (on a call-to-call basis) digital link to the telecommunication carrier. An ISDN line can transmit information nearly 5 times faster than can be achieved using analog modems over plain old telephone service (POTS) [13].

POTS

This technological tool transmits data at a rate of up to 56 kbps (kilobits/sec) (Bezar 1995) and is the most commonly obtainable telecommunication technology in the world. POTS is generally suited for audio conferencing, store-and-forward communication, internet, and low bandwidth video-conferencing.

T-1

T-1 is the spine of digital communication which is made available to the end-user in the USA today that conveys voice and data digitally at 1.554 Mbps (megabits/sec). It can also be used to carry analog and digital voice, data, and video signals. It can even be configured for ISDN service.

Internet

Health-care systems have been tremendously been supplemented by internet facilities across majority of nations. Globally, the internet has played a commendable role in health-care delivery systems today. With the increasing proliferation of e-health sites on the web today, many consumers are finding trouble-free access to online patient scheduling, health learning, assessment of laboratory reports, and even E-mail consultations.

TELEMEDICINE: APPLICATIONS IN PUBLIC HEALTH

Epidemiological surveillance using geographic information systems (GISs)

Telemedicine has been progressively attaining new insights in surveillance of epidemics with tools such as GISs. GISs can give information about geographical distribution and gradient in disease incidence and prevalence, thereby, revealing an overall population health assessment. It helps in differentiating and delineating the at-risk population based on their risk factor profiles. It also helps in interventional planning and assessing the effectiveness of various interventional strategies.

GIS can play a crucial role in anticipating epidemics and in real-time monitoring of diseases, both locally and globally. Spatial-temporal modeling of climate, environment, and disease transmission has been made possible through GIS which provides fundamental design and analytical tools, using remote sensing technology. GIS-based methods for retrieving, analyzing, and managing data ease aggregation and integration of data from varied sources to guide the formulation of public health policies and programs [13].

Interactive health communication

Information technology by telemedicine can be used to update, influence, and encourage populations on healthy lifestyles and health-related matters. The various communication approaches can support primary, secondary, and tertiary health prevention programs. It facilitates informed decision-making, peer information exchange, emotional support, and provision of a broader choice base among health-care seekers. It simplifies the decision-making process by advancing communication between health-care providers and individuals regarding the prevention and management of a health condition.

Moreover, it can go a long way in promoting and maintaining healthy lifestyles in the community. It promotes self-care and domiciliary care practices, which even allows for self-management of health problems for people living in remote areas. It can also be used for the evaluation and monitoring of health-care policies and programs.

TELEMEDICINE IN INDIA

At present, there are lots of challenges in Indian health-care system to provide total primary care in rural areas. Nonetheless, secondary and tertiary health care is non-homogeneously available even in suburban and urban areas. Enticement to specialists for practicing in rural and suburban areas had also failed grossly. In contrast to the challenging scenario in healthcare, computer literacy is emerging rapidly in India. Health-care providers are now looking at telemedicine as their newly found technological discovery. In theory, it is relatively easy to set up an exceptional telecommunication infrastructure in suburban and rural areas of India than to place hundreds of specialists at these locations. We have realized that the future of telecommunications lies in satellite-based technology and fiber optic cables [14].

The Apollo group of hospitals has been the pioneer in establishing a pilot project at a secondary care hospital in the village Aragonda (The Aragonda project), 16 km from Chittoor (with a population of 5000), Andhra Pradesh. Initiating from simple web cameras and ISDN telephone lines, today, the village has a state-of-the-art videoconferencing facility and a Very Small Aperture Terminal (VSAT) satellite installed by Indian Space Research Organization (ISRO). The project coupled with the Sriharikota (130 km from Chennai) Space Center project created a significant launch pad for the ISRO in the field of telemedicine [2].

Telemedicine responses are being endorsed to provide quality healthcare to patients in rural and far-flung locations by the specialists sitting in

another location by information and communication technology (ICT). This has helped in overcoming the all-time challenge of Human Resource for Health insufficiency for health-care delivery to remote, hard, inaccessible, and tribal areas and in every state and union territory. This multifaceted use of ICT has made it possible for a single doctor to attend to more patients and make online prescriptions (Table 1).

m-Health, that is, use of mobile phones and wireless-enabled Personal Digital Assistants to deliver health services and transmit health-related information, has also emerged as one of the significant divisions of telemedicine. The m-Health tools have established excellent health results and they have enormous potential as mobile phone diffusion rises and the information base for ICT continues to grow.

In India, telemedicine programs have been keenly supported by: Department of Information Technology (DIT), Ministry of Health and Family Welfare (MOHFW), ISRO, NEC Telemedicine program for North-east states, Apollo Hospitals, Asia Heart Foundation, State governments. Telemedicine technology is also supported by some other private organizations [15]. DIT as a catalyst with the long-term target of effective use and absorption of ICT in all the major sectors has taken the following leads in telemedicine: Launch of various pilot schemes in selected specialties such as oncology, tropical diseases, and general telemedicine systems covering all specialties and outline for building IT infrastructure in health [15].

At the national level, MOHFW has been in the course of developing the National Medical College Network wherein 41 Government Medical Colleges are being grouped in the first phase for forming an National Knowledge Network with the aim of e-Education and e-Healthcare delivery and outreach.

Centre for Development of Advanced Computing supporting telecardiology, teleradiology, telepathology, etc. has also developed the telemedicine software system. Initially, three premium institutess of our country inkling All India Institute of Medical Sciences, New Delhi, Sanjay Gandhi Post Graduate Institute of Medical Sciences, Lucknow, and Post Graduate Institute of Medical Education and Research, Chandigarh were connected using ISDN, VSAT, and POTS. Later on, other medical centers in Rohtak, Shimla, and Cuttack were also connected [15].

Over the period of time, ISRO has expanded telemedicine network covering the entire country from North to South and East to West, ranging from urban areas to remote areas like the mountainous and hilly regions of Jammu and Kashmir including Kargil and Leh, offshore islands of Andaman and Nicobar and Lakshadweep, Medical College hospitals in Orissa, and some of the district hospitals in the mainland states. Thus, more than 45 remote and rural hospitals and 15 super specialty hospitals are covered initially and further expansion to cover entire country is in the process.

One of the biggest telemedicine non-profitable network was carried out between Narayana Hrudayalaya (NH) Bangalore, Rabindranath Tagore International Institute of Cardiac Sciences Calcutta, ISRO, Hewlett Packard, and the State Governments of the seven North-east states of India. NH at Bangalore and the Rabindranath Institute at Kolkata became the main telemedicine linking hub for the seven states. Free of cost specialists and super specialists' services are provided free of cost in this project. In need-based locations, 100 bedded hospitals in each of these states were identified and connected to these networks considering the remoteness, requirement, distance from state capital, and non-availability of coronary care unit.

Various such telemedicine projects were successfully launched across the country. One such example is the Karnataka Telemedicine Project which has provided thousands of teleconsultations and brought multispecialty care to significant number of people across the state. A telemedicine utilization network under the name of HEALTH STAT was thus launched. Similarly, the most of the states have initiated widespread network of telemedicine network across the country.

TELEMEDICINE DURING COVID PANDEMIC

A public health emergency of international concern was created by COVID-19 in early 2020, where in people were put under home self-isolation, social distancing, and movement restriction to curtail the spread of the virus. In fact when hit during the first wave, the entire world was in a situation of lockdown with travel restrictions been enforced and most cities quarantined [16]. It was during this time that telemedicine importance came into role to maximum extent and was used to very great extent with good result [17]. It emerged as an effective way to use the existing technologies to maximize reach, minimum cost, and effective health care while minimizing the hazard of direct person to person contacts [16,18]. Telemedicine during this pandemic condition had the highest potential to improve effective research of epidemiological, management and control of disease at a larger scale with minimum time, and person involvement [16,18,19]. During this pandemic, technology was used in all spheres of life, starting from home monitoring to airport screening, to registration, testing, and vaccination portals and apps. Online mental health surveys enabling mental health professionals with communication programs to render mental health services were highly appreciated [20]. Telemedicine also provided several benefits in providing allergy and immunology services to access to rapid evaluation for COVID-19 infection [21].

Although COVID-19 pandemic has given a highest level of importance to telemedicine, there were unintended consequences of telehealth, the biggest being the incomplete or inaccurate physical examination. COVID-19 potentiated the historically abandonment of physical touch and examination due to advances in patient technological assessments [22]. Although this was the fact, the same technology is being used to overcome this issue by documenting steps to perform virtual physical examination that can be used and applied to wide variety of patients encounters [23]. Similarly, Tanaka *et al.* [24] described in their study about creative methods to do virtual orthopedic examination. However, there are plethora of limitations in carrying out the virtual examinations accurately and need lots of creativity, innovation, and application of everyone's at each stage [25-27]. Thus, in the future, precision in the approach and delivery of the telehealth is essential [28].

On these lines, with the vision of Atmanirbhar Bharat of India, building a resilient and sturdy health-care system forms the foundation and telemedicine forming the core. Thus, in 2018, Ayushman Digital Mission and PM Ayushman Bharat Health Infrastructure Mission were launched with "the focus on wellness and quality of care." Under this, various policies were framed. One among them was formulation and implementation of a health data retention guideline/policy [29] for India to ensure uniformity among all health-care facilities. Various studies and evidences across world have proved that strong health data governance systems have secured and strengthened health care and public health delivery systems [30-34]. Considering all these facts and evidence, a National Digital Health Ecosystem was launched in September 2021 so that universal health care is supported in an efficient and safe manner with provision of wide range of data, information, and infrastructure services with standard digital systems ensuring confidentiality and privacy [35].

CHALLENGES [8]

As with any new changes being introduced, there are lots of challenges in implementation of telemedicine. One of the most important is the negative perspective of medical practitioners since doctors not fully convinced and familiar with e-medicine and latest technologies. At the same time, on the other end, even patients are also lack confidence in getting accurate services and better outcome with telemedicine than compared to humanly touch approach of doctor-patient relationship. The cost and connectivity of telemedicine technology and software functionality in remote areas are always an issue.

India being a developing country with lots of socioeconomic factors playing role has lots of hindrance in implementation of telemedicine

AQ5 **Table 1 : Telemedicine: Role in diverse spheres**

1	Uncomplicated reach to remote areas
2	Significant decrease of the time and overheads over patient transportation
3	Monitoring the protocol of at-home and ambulatory care of patients
4	Critical care supervision where patient transfer is unlikely
5	Enhancing communications between health-care providers located at different geographical sites
6	Continuing medical education and clinical research
7	Generating public awareness
8	Disaster management
9	For second expert opinion and complex interpretations
10	Telemonitored surgical procedures using hand held robots
11	Disease surveillance and epidemiological case tracking
12	Providing an opportunity for standardization and equality in provision of healthcare within countries, across regions, and continents

network in fully extended phase. It is because, a very high proportion of our population is below poverty line and even the basic amenities such as safe drinking water, transportation, and telecommunication are missing in remote areas. When a person has nothing to change, no technological advancement can change anything. Moreover, the literacy rate is also poor and most difficult part being multi-language country with lack of English-speaking skills in many. However, with the latest translative services, the telemedicine softwares can be operated through different languages removing the language barrier.

Even technical constraints and quality aspects need major advancement, backed by high end software and hardware so that with advanced biological sensors and more bandwidth support, diagnosis can be made accurate and better features become available. It also needs proper governing body to form guidelines on various aspects including quality aspect and motivating the organizations to follow it. To be successful, telemedicine also needs good government backup and support by private organizations including non-governmental organizations and corporate civic responsibilities.

CONCLUSION

Telemedicine thus has a bright future and definitely we can imagine realizing that it would become another way to see a health professional. Within the same time frame, patient-related data can be simultaneously get collected for large number of people using remote monitoring. However, there is always a disadvantage if any issue arises due to software and hardware. Thus, computer-based patient monitoring can be problematic at sometimes if we exclusively depend on computer system. Hence, there should always be a balance between computer dependency and human intelligence use. Each and every one's life difference can be made by maintaining the balance between the two. It is the near future only, to decide whether telemedicine is a "forward step in a backward direction" or to paraphrase Neil Armstrong "one small step for IT but one giant leap for healthcare."

ACKNOWLEDGMENTS

I acknowledge and thank all my coauthors and study participants.

AUTHORS' CONTRIBUTIONS

All authors have contributed to the preparation of the manuscript.

CONFLICTS OF INTEREST

Nil.

AUTHORS' FUNDING

Nil.

REFERENCES

1. Brown N. A brief history of telemedicine. Telemed Inf Exch 1995;105:833-5.
2. Ganapathy K. Neurosurgeon. Chennai: Apollo Hospitals, Telemedicine in India-the Apollo Experience, Neurosurgery on the Web; 2001.
3. Bashshur RL, Armstrong PA, Youssef ZI. Telemedicine: Explorations in the Use of Telecommunications in Health Care. Springfield, IL: Charles C Thomas; 1975.
4. Bashshur R, Lovett J. Assessment of telemedicine: Results of the initial experience. Aviat Space Environ Med 1977;48:65-70. PMID 831717
5. Bashshur R. Superintendent of Documents. Technology Serves the People: The Story of a Cooperative Telemedicine Project by NASA, the Indian Health Service and the Papago People. Washington, DC: US Government Printing Office; 1980.
6. Watson DS. Telemedicine. Med J Aust 1989;151:62-6. 8,71.
7. Foote D, Hudson H, Parker EB. Telemedicine in Alaska: The ATS-6 Satellite Biomedical Demonstration. National Technical Information Service (NTIS) Springfield, VA: US Department of Commerce; 1976.
8. Report of the Technical Working Group on Telemedicine Standardization, Technical Working Group for Telemedicine Standardization Department of Information Technology (DIT), Ministry of Communications and Information Technology (MCIT); May 2003.
9. Houtchens BA, Allen A, Clemmer TP, Lindberg DA, Pedersen S. Telemedicine protocols and standards: Development and implementation. J Med Syst 1995;19:93-119. doi: 10.1007/BF02257060, PMID 7602256
10. Mezrich RS, DeMarco JK, Negin S, Keller I, Schonfeld S, Safer J, *et al*. Radiology on the information superhighway. Radiology 1995;195:73-81. doi: 10.1148/radiology.195.1.7892498, PMID 7892498
11. Dasgupta A, Deb S. Telemedicine: a new horizon in public health in India. Indian J Community Med. 2008;33:3-8. doi: 10.4103/0970-0218.39234
12. Wachter GW. Telecommunication, linking providers and patients. Telemed Inf Exch 2000.
13. Kopp S, Schuchman R, Stretcher V, Gueye M, Ledlow J, Philip T, *et al*. Telemedicine. Telemedicine J E Health 2002;8:18.
14. Grigsby B, Brown N. ATSP Report on US Telemedicine Activity. Portland: Association of Telehealth Service Providers; 1999.
15. Bedi BS. Telemedicine in India: Initiatives and Perspective, eHealth 2003: Addressing the. Divide: Digital Press; 2003.
16. Smith AC, Thomas E, Snoswell CL, Haydon H, Mehrotra A, Clemensen J, *et al*. Telehealth for global emergencies: Implications for coronavirus disease 2019 (COVID-19). J Telemed Telecare 2020;26:309-13. doi: 10.1177/1357633X20916567, PMID 32196391
17. Monaghesh E, Hajizadeh A. The role of telehealth during COVID-19 outbreak: A systematic review based on current evidence. BMC Public Health 2020;20:1193. doi: 10.1186/s12889-020-09301-4, PMID 32738884
18. Zhou X, Snoswell CL, Harding LE, Bambling M, Edirippulige S, Bai X, *et al*. The role of Telehealth in reducing the mental health burden from COVID-19. Telemed J E Health 2020;26:377-9. doi: 10.1089/tmj.2020.0068, PMID 32202977
19. Ohannessian R. Telemedicine: Potential applications in epidemic situations. Eur Res Telemed 2015;4:95-8. doi: 10.1016/j.eurtel.2015.08.002
20. Liu S, Yang L, Zhang C, Xiang YT, Liu Z, Hu S, *et al*. Online mental health services in China during the COVID-19 outbreak. Lancet Psychiatry 2020;7:e17-8. doi: 10.1016/S2215-0366(20)30077-8, PMID 32085841
21. Shaker MS, Oppenheimer J, Grayson M, Stukus D, Hartog N, Hsieh EW, *et al*. COVID-19: Pandemic contingency planning for the allergy and immunology clinic. J Allergy Clin Immunol Pract 2020;8:1477-88.e5. doi: 10.1016/j.jaip.2020.03.012, PMID 32224232
22. Offline HR. Touch – The first language. Lancet 2019;394:1310.
23. Benziger CP, Huffman MD, Sweis RN, Stone NJ. The telehealth ten: A guide for a patient-assisted virtual physical examination. Am J Med 2021;134:48-51. doi: 10.1016/j.amjmed.2020.06.015, PMID 32687813
24. Tanaka MJ, Oh LS, Martin SD, Berkson EM. Telemedicine in the era of COVID-19: The virtual orthopaedic examination. J Bone Joint Surg Am 2020;102:e57. doi: 10.2106/JBJS.20.00609, PMID 32341311
25. Saliba-Gustafsson EA, Miller-Kuhlmann R, Kling SM, Garvert DW, Brown-Johnson CG, Lestoquoy AS, *et al*. Rapid implementation of video visits in neurology during COVID-19: Mixed methods evaluation. J Med Internet Res 2020;22:e24328. doi: 10.2196/24328, PMID 33245699
26. Hoenig H, Tate L, Dumbleton S, Montgomery C, Morgan M,

Landerman LR, *et al*. A quality assurance study on the accuracy of measuring physical function under current conditions for use of clinical video telehealth. Arch Phys Med Rehabil 2013;94:998-1002. doi: 10.1016/j.apmr.2013.01.009, PMID 23337425

27. Yager PH, Clark ME, Dapul HR, Murphy S, Zheng H, Noviski N. Reliability of circulatory and neurologic examination by telemedicine in a pediatric Intensive Care Unit. J Pediatr 2014;165:962-6.e1. doi: 10.1016/j.jpeds.2014.07.002, PMID 25112695
28. Reeves JJ, Ayers JW, Longhurst CA. Telehealth in the COVID-19 era: A balancing act to avoid harm. J Med Internet Res 2021;23:e24785. doi: 10.2196/24785, PMID 33477104
29. Consultation Paper on Proposed Health Data Retention. Policy Press, Ministry of Health and Family Welfare. Available from: https://abdm.gov.in/assets/uploads/consultation_papersDocs/Consultation_Paper_on_Health_Data_Retention_Policy_21.pdf. [Last accessed on 2022 Feb 01].
30. EHealth Network. Gov Model eHealth Digit Serv Infrastruct during CEF Funding; 2015.
31. Research2Guidance. Diabetes Care Market 2018-2022: Digital Press; 2018. Available from: https://research2guidance.com/wp-content/uploads/2018/08/R2G-Digital-Diabetes-CareMarket-2018-2022-Ready-To-Take-Off-Report-Preview.pdf. [Last accessed on 2022 Feb 01].
32. ESPON Future Digital Health in the EU Scientific Access. Available from: https://www.espon.eu/sites/default/files/attachments/Scientific%20annexes.%20TG%202019%2003%2025_final%20version_0.pdf. [Last accessed on 2022 Feb 01].
33. EU. Estonia's Unique E-Health: Thousands of Data Fields, One Personal Health Record; 2017. Available from: https://www.eu2017.ee/news/press-releases/estonias-unique-e-health-thousandsdatafields-one-personal-health-record. [Last accessed on 2022 Feb 01].
34. Kauppinen H, Ahonen R, Mäntyselkä P, Timonen J. Medication safety and the usability of electronic prescribing as perceived by physicians – A semistructured interview among primary health care physicians in Finland. J Eval Clin Pract 2017;23:1187-94. doi: 10.1111/jep.12759, PMID 28474487
35. Ayushman Bharat Digital Mission (ABDM). Press Information Bureau. Available from: https://www.india.gov.in/spotlight/ayushman-bharat-digital-mission-abdm. [Last accessed on 2022 Feb 01].