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TELEMEDICINE : NEW ERA OF HEALTH SERVICE

Md. Iqbal Hossain[1*] Nasima Akter[2] Abdur Rahman[3]

Abstract

Telemedicine has the potential to help facilitate the delivery of health services to rural and remote areas. In somecircumstances, telemedicine may also be useful for the delivery of education and teaching programmes and the facilitation of administrative meetings. In this paper reference is made to a variety of telemedicine applications. An overriding imperative is to focus on the clinical problem first with careful consideration given to the significant organisational changes which are associated with the introduction of a new or alternative method of health service delivery for remote patients. For telemedicine to be effective it is also important that all sites involved are adequately resourced in terms of staff, equipment, telecommunications, technical support and training. In addition, there are a number of logistical factors which are important when considering the development of a telemedicine service including site selection, clinician empowerment, telemedicine management, technological requirements, user training, telemedicine evaluation, and information sharing through publication.

Key words

Telemedicine; ICT; Health information technologices; Integrated service digital network.

Introduction

What is Telemedicine?

Telemedicine provides healthcare where there is none and improve the health care where there is some.The use of electronic information and communications technologies that provide and support health care when distance separates the participants.Telemedicine means "distance healing".They derived from a Greek word 'Tele' meaning "distance" and a Latin word "mederi" meaning "to heal".Thomas Bird used this phrase for the first time in the 1970s when referring to health care delivery where physicians examine distant patients through the use of telecommunications technologies[1]. This is not one specific technology but a way of providing healthcare services at a distance using telecommunications technology, medical expertise & computer science[2].

In spite of numerous studies, unfortunately there is no integrated definition of telemedicine. The definition of the term telemedicine as accepted by World Health Organization is, The delivery of health care services, where distance is a critical factor, by all health care professionals using information and communication technologies for the exchange of valid information for diagnosis, treatment and prevention of disease and injuries, research and evaluation, and for the continuing education of health care providers, all in the interests of advancing the health of individuals and their communities[3].

Search Strategy

Available studies and abstracts were identified through PubMed and Medline data bases (From 2003-2019) and Cochrane data bases. Key Search topic were "Telemedicine : New Era of Health Service" and relevant articles. The reference list of review article were also searched. The search term were following key words used in verious combination : ICT; Telemedicine; In tegrated service digital network; Health information technologices.

Discussion

Origins and History Telemedicine

Telemedicine history goes back to the nineteenth century. According to this history, this phrase was introduced with one of the first reports published in the twentieth century at which time electrocardiography data was transmitted over telephone wires[4,5]. Commercial equipment forthe development of telemedicine in the 1960s was used by the military and space technology departments as well

1. Professor of Orthopaedic Surgery
Chattogram Medical College, Chattogram.
2. Professor of Pathology
Chattogram Medical College, Chattogram.
3. Registrar of Orthopaedic Surgery
Chattogram Medical College Hospital, Chattogram.

***Correspondence:** **Dr. Md. Iqbal Hossain**
E-mail: nasima 1961@yahoo.com
Cell: 01711 76 12 76

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as private individuals[6].Theuse of TV to facilitate relationship between specialists at a psychiatric institute and general practitioners at a state mental hospital and providing medical advice from a major teaching hospital to an airport medical center can be noted as some examples of early technological milestones in telemedicine. Many parameters have been described as drivers of telemedicine over the past decade, the biggest ones include recent advancements in, and increasing availability and utilization of, ICTs by the general population, rapidly creating new possibilities for health care service and delivery[7,8]. Developing countries and disadvantaged areas of industrialized nations follows this[9]. The use of telemedicine among health-care providers has been increased due to the replacement of analogue forms of communication with digital methods, combined with a rapid drop in the cost of ICTs. These have made health care organizations enable to imagine as a future possibility and use new and more efficient methods of providing care[10].

Early Telemedicine

According to available evidence, for communicate of medical information, some communication intermediaries have been used, especially smoke signals and light reflections. Telecommunication methods have been used to indicate the prevalence of infections and to inform about health events such as birth or death. In this way, smoke signals were used to indicate the occurrence of medical and health incidents by American Indian tribes in ancient Greece[2].

As we know, for the first time, telemedicine was introduced in the April 1924 issue of Radio News magazine. The magazine described that how a patient can communicate with a doctor, including use of heartbeat and temperature indicators. An imagination of the future was formed the basis of the concept, as U.S. residents did not yet have televisions in their homes, and radio adoption was just gaining steam. In the early 1900s, suggestions were made for the transmission of data related to stethoscope and other devices through communication channels (Telephone, radio etc). Nevertheless, none of these experiments did not succeed. It has reported that for the first time telemedicine to transmit video, images, and complex medical data were used in the late 1950s and early 1960s. In 1959, in order to transmit neurological examinations, interactive telemedicine was used by the University of Nebraska, which is widely considered the first case of a real-time video telemedicine consultation[2].

According to studies, there was a major break for the progress of telemedicine in 1960s when several partners decided to join together to work on Space Technology Applied to Rural Papago Advanced Health Care (STARPAHC) project, these partners include the National Aeronautics and Space Administration (NASA) Lockheed Corporation and U.S. Indian Health Service. (STARPAHC) is considered as a large-scale telemedicine project. Telemedicine access was provided to an American Indian reservation using the same technologies intended for astronauts on space missions. Many initiatives in relation with grant and government-supported telemedicine have been reported, including[11]

i. Providing medical care in a war zone
ii. Providing medical care to remote scientific stations in Arctic and Antarctic
iii. Providing medical care to correctional transporting inmates to the hospital. facilities without
iv. Digital transmission of radiology images.

Types of Telemedicine

The common thread for all telemedicine applications is that a client of some kind (e.g patient or health-care worker) obtains an opinion from someone with more expertise in the relevant field, when the parties are separated in space, in time or both. Telemedicine episodes may be classified on the basis of:

i) The interaction between the client and the expert

ii) The type of information being transmitted.

The type of interaction is usually classified as either prerecorded or store-and-forward (Also called asynchronous) or realtime (Also called synchronous).

In real time it requires the presence of patients, primary physician and consultant at the same time at two different places. For this, video-conferencing equipment and other facilities are required. There are also peripheral devices which can be attached to computers or the video-conferencing equipment which can aid in an interactive examination. For instance, a tele-otoscope allows a remote physician to see inside a patient's ear, a telestethoscope allows the consulting remote physician to hear the patient's heartbeat.

In the asynchronous situation, information is acquired and stored in some format, before being sent, by an appropriate means, for expert interpretation at some later time. Email is a common method of store and forward interaction. In contrast, in realtime interactions, there is no appreciable delay between the information being collected, transmitted and displayed. Interactive communication between individuals at the sites is therefore possible. Video conferencing is a common method of realtime interaction. The information transmitted between the two sites cantake many forms, including data and text, audio, still images and video pictures. Combining the type of interaction and the type of information to be transmitted allows telemedicine episodes to be classified. In certain applications, such as teleradiology, a technique that involves the transmission of digital radiographs between institutions, it is possible for the interaction to be either prerecorded or realtime; the latter requires that the expert be available to give an opinion as the image is taken and transmitted.

The Interrelationship Between Health Information Technology and Telemedicine

The goals and activities of telemedicine and health IT are complementary and synergistic. Telemedicine is a method of delivering health care that makes use of health information technologies to accomplish its goals. Conversely, Health Information Technologies (HIT) are an enabling component to the delivery of health services over distances, providing fundamental tools and systems. In short, HIT greatly enhances the utility of telemedicine.

It is also important to acknowledge a distinction-telemedicine is not a type of HIT. Certainly telehealth is dependent on the use of telecommunications and related forms of advanced technologies but it fundamentally describes the delivery of patient and consumer care. Insome respects the distinction reflects a difference between clinicians and the IT world. It is important that the differences be recognized, understood and accepted so that telehealth and HIT can work together in order to optimize the delivery of health care[12].

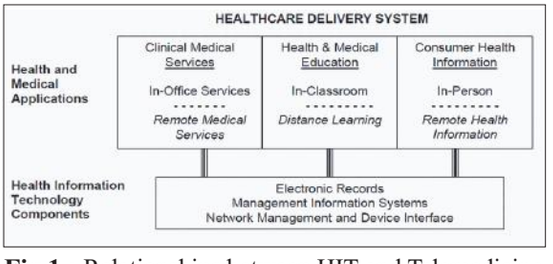

Fig 1 : Relationships between HIT and Telemedicine

Technologies are Used in Telemedicine

While telemedicine relies on a number of technologies, telecommunications technology is necessary to enable communication between two or more sites. Although Plain Old Telephone Service (POTS) and Integrated Service Digital Network (ISDN) are sufficient for many telemedicine interactions, they are limited in their ability to support more complex telemedicine applications, such as video conferencing between more than two sites and transferring medical images at the level of quality needed for accurate diagnoses. Such applications rely on a high- speed Internet connection, or broadband. Broadband refers to a high-speed, always-on connection to the Internet, which enables information to be transferred with very little delay in receiving or sending[13]. For optimal telemedicine performance, the broadband connection must be of sufficient bandwidth to enable all connection points to send and receive large amounts and complex sets of data quickly and accurately. Security measures must also be in place to ensure that data are transferred only to the intended recipients, protecting patients' privacy.

Telemedicine also uses an ever-growing menu of software and technological devices, including videoconferencing equipment, digital cameras; electronic clinical devices, such as digital stethoscopes; and disease management and health education software. Telemedicine is utilizes wireless devices, such as cell phones and Personal Digital Assistants, to exchange data[12].

Fig 2: Use of telemedicine[14]

Current State of Telemedicine Services

Telemedicine is mostly beneficial for populations living in isolated communities and remote regions and is currently being applied in virtually all medical domains.Use a 'tele-' prefix; there are many subdivision of it such as,Telepathology, Telecardiology, Teleradiology, Telesurgery, Teleopthalmology, Telegynaecology etc.

To obtain an impression of the current state of telemedicine service provision, four of the most popular and established areas of telemedicine were surveyed specifically. Respondents were asked to indicate whether or not their country offered a service in each field, and if so, to give its level of development. Levels of development were classified as ‘established’ (Continuous service supported through funds from government or other sources) ‘pilot’ (Testing and evaluation of the service in a given situation) or ‘informal’ (Services not part of an organized programme). The survey examined four fields of telemedicine[8].

- Teleradiology : Use of ICT to transmit digital radiological images (e.g X-ray images) from one location to another for the purpose of interpretation and/or consultation.
- Telepathology : Use of ICT to transmit digitized pathological results (e.g microscopic images of cells) for the purpose of interpretation and/or consultation.
- Teledermatology : Use of ICT to transmit medical information concerning skin conditions (e.g tumours of the skin) for the purpose of interpretation and/or consultation.
- Telepsychiatry : Use of ICT for psychiatric evaluations and/or consultation via video and telephony.

Telemedicine Services Globally

Teleradiology is currently the most developed telemedicine service area globally, with just over 60% of responding countries offering some form of service and over 30% of countries having an established service (Table I). While the proportion of countries with any form of service ranged from almost 40% for teledermatology and telepathology to approximately 25% for telepsychiatry, the proportion of countries with established services in those three areas was comparable at approximately 15%[8].

Table I : Global implementation rates of telemedicine services

	Established	Pilot	Informal	No Stage Provided	Total
Teleradiology	33%	20%	7%	2%	62%
Telepathology	17%	11%	9%	4%	41%
Teledermatology	16	12%	7%	3%	38%
Telepsychiatric	13%	5%	5%	1%	24%

Benefit of Telemedicine

Telemedicine has obvious advantages in remote or rural areas where it improves access to health services, obviating the need for patients and health-care workers to travel. Even in urban areas, however, telemedicine can improve access to health services and to information. Telemedicine has also been shown to improve the consistency and quality of health care[15]. It may sometimes also be cheaper than conventional practice, although, as previously mentioned, scientifically sound economic appraisals of telemedicine applications are only just beginning to appear. There is argument for the need for research for all telemedicine applications prior to widespread adoption, this is surely it.

In broad terms, telemedicine can be expected to improve equity of access to health care, the quality of that care and the efficiency by which it is delivered, by enhancing communication up and down the health care pyramid. Widespread adoption of telemedicine would permit decentralization,resource utilization, early intervention, avoids unnecessary transportation, community based care, medical education and research, cost saving and improved patient documentation.

Increased range of care and education work previously done in the secondary sector, for example, could be performed in primary care and work previously done in the primary care sector could be devolved to the community level. Such changes, if implemented in the developing world, could potentially have the greatest effect, allowing underserved people to benefit from a greatly improved standard of health care. In all remote or rural areas, however, telemedicine could have a great impact, permitting among other opportunities, better diagnostic and therapeutic services, faster and easier access to medical knowledge, and enhanced communication between health-care workers.

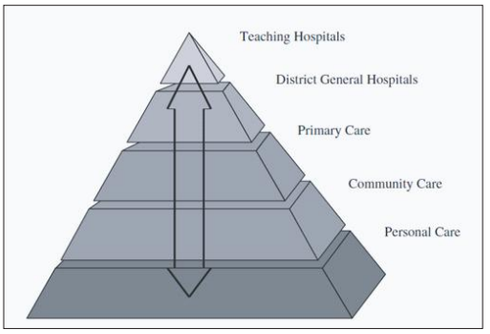

Fig 3 : Telemedicine as a means for improving communication up and down the health-care pyramid[15]

Telemedicine holds great potential for reducing the variability of diagnoses as well as improving clinical management and delivery of health care services worldwide by enhancing access, quality, efficiency, and cost-effectiveness[4,13]. In particular, telemedicine can aid communities traditionally underserved – those in remote or rural areas with few health services and staff-because it overcomes distance and time barriers between health-care providers and patients[4]. Further, evidence points to important socioeconomic benefits to patients, families, health practitioners and the health system, including enhanced patient-provider communication and educational opportunities[15].

Despite its promise, telemedicine applications have achieved varying levels of success. In both industrialized and developing countries, telemedicine has yet to be consistently employed in the health care system to deliver routine services, and few pilot projects have been able to sustain themselves once initial seed funding has ended[14].

Potential Barriers to Telemedicine

Several routinely cited challenges account for the lack of longevity in many telemedicine endeavors. One such challenge is a complex of human and cultural factors. Some patients and health care workers resist adopting service models that differ from traditional approaches or indigenous practices, while others lack ICT literacy to use telemedicine approaches effectively. Most challenging of all are linguistic and cultural differences between patients (Particularly those underserved) and service providers[6,16]. A shortage of studies documenting economic benefits and cost-effectiveness of telemedicine applications is also a challenge. Demonstrating solid business cases to convince policy-makers to embrace and invest in telemedicine has contributed to shortcomings in infrastructure and underfunding of programs[4].

Legal considerations are a major obstacle to telemedicine uptake. These include an absence of an international legal framework to allow health professionals to deliver services in different jurisdictions and countries; a lack of policies that govern patient privacy and confidentiality of data transfer, storage, and sharing between health professionals and jurisdictions; health professional authentication, in particular in e-mail applications; and the risk of medical liability for the health professionals offering telemedicine services[17].

Related to legal considerations are technological challenges. The systems being used are complex, and there is the potential for malfunction, which could trigger software or hardware failure. This could increase the morbidity or mortality of patients and the liability of health-care providers as well[18]. In order to overcome these challenges telemedicine must be regulated by definitive and comprehensive guidelines, which are applied widely, ideally worldwide. Concurrently, legislation governing confidentiality, privacy, access, and liability needs to be instituted[19]. As public and private sectors engage in closer collaboration and become increasingly interdependent in eHealth applications, care must be taken to ensure that telemedicine will be deployed intelligently to maximize health services and optimal quality and guarantee that for-profit endeavors do not deprive citizens access to fundamental public health services[19]. In all countries, issues pertaining to confidentiality, dignity, and privacy are of ethical concern with respect to the use of ICTs in telemedicine. It is imperative that telemedicine be implemented equitably and to the highest ethical standards, to maintain the dignity of all individuals and ensure that differences in education, language, geographic location, physical and mental ability, age, and sex will not lead to marginalization of care[19].

Key Lessons from the Literature to Overcome Barriers

Health system transformation requires the involvement of all stakeholders. Partnerships usually facilitate change and the telemedicine sector is no different. Community leaders, health professionals, academic institutions and educators, health administrators and policy-makers represent "social accountability partnership pentagram" which is the best alliance to make changes necessary to reflect and react to societal needs in health

sector. Five key lessons were drawn from this review, which helps to establish telemedicine; they are described below:-

Lesson I: Collaboration, participation, and capacity building are fundamental to the success and sustainability of telemedicine initiatives.

Lesson II: Organizations and individuals engaging in telemedicine initiatives in developing countries need to be aware of the local context in which they work, i.e available resources, needs, strengths and weaknesses.

Lesson III: Use simple solutions that appropriately meet the needs of a clinical context or community to optimize cost-effectiveness and minimize complexity in change management.

Lesson IV: Evaluation is vital for scalability, transferability, and continuing quality improvement of telemedicine, it should include documentation, analysis, and dissemination.

Lesson V: The social benefits of telemedicine contribute to the health of communities and human development, and are important goals unto themselves[8].

Conclusion

Telemedicine offers great opportunity as an alternative method of health service delivery to rural areas. Although there are many examples of successful telemedicine applications in a wide range of clinical practice settings, more research is required to prove clinical and cost effectiveness. While considering a new telemedicine application, it is important to consider a range of logistical factors. A common and expensive mistake for telemedicine service developers is to focus entirely on the technology. It is recommended that new services be piloted on a small scale and gradually developed if proven beneficial. To conduct telemedicine successfully, it is important that all sites involved are well resourced with the appropriate personnel, equipment, telecommunications, technical support and training.

Recommendation

There is no doubt that telemedicine is effective in certain situations. The transition to a world where telemedicine is employed to the maximum will not be realized, however, if governments and health-care organizations do not produce strategies to encourage its development. The critical issues will need to be addressed in such strategies as part of a fourfold commitment: to encourage and provide funding for telemedicineresearch; to develop a plan for implementation (Once clinical effectiveness and cost-effectiveness have been demonstrated) to assess the major structural changes required within organizations to incorporate this method of delivering health care to develop a process for training, formulation of practice guidelines, quality control and continuing audit. Other issues that will need to be addressed include ethical and medicolegal concerns, human and cultural factors, such as resistance to change, lack of infrastructure, linguistic differences and illiteracy, and technical and organizational factors. None of these should be insurmountable. Good decisions about the 'right' type of telemedicine delivery thus require careful balancing challenges of medical access, technology availability, practitioner discretion, and consumer preference rather than adhering to rigid notions of being limited to an ideal modality under ideal circumstances. Part of the challenge is to understand and distinguish varying patient needs and how telemedicine applies to those circumstances specifically. Virtual treatment of hay fever, for example, differs markedly from home monitoring of congestive heart failure and cannot be evaluated as the same intervention[7].

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Disclosure

All authors declared no competing interest.

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