



The Brief Review on Telemedicine: New Dream in Developing Countries

Haleh Farzin¹, Hanieh Sakha^{2,*} and Reza Eslahi³

¹Research Centre, Faculty of Medicine, Tabriz University of Medical Sciences, Tabriz, Iran

²Islamic Azad University, Tehran North Branch, Tehran, Iran

³Master of Business Administration, Tehran, Iran

* Corresponding author: Islamic Azad University, Tehran North Branch, Tehran, Iran. Email: h.dsakha@yahoo.com

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Abstract

In the new modern world, technology has a remarkable role in human life and affects all aspects of it. Indeed, the need for rapid counteractions, especially in medical requirements, can lead to interesting innovations. Telemedicine was disregarded for being an unwieldy, unreliable, and unaffordable technology. Rapidly evolving telecommunications and information technologies have provided a solid foundation for telemedicine as a feasible, dependable, and useful technology. Telemedicine has been conceived as an integrated system of healthcare delivery that employs telecommunications and computer technology as a substitute for face-to-face contact between provider and client. It has the potential for ameliorating seemingly intractable problems in healthcare such as limited access to care among segments in the population, especially the geographically disadvantaged, uneven quality of care, and cost of inflation. Its true merit has yet to be determined by systematic empirical studies. In another survey, the authors defined telemedicine as a branch of e-health, which works by communication networks and delivers healthcare and medical educations from remote locations. The main aim of telemedicine is to overcome the improper distribution of human and fundamental resources. Telemedicine could be considered from the viewpoint of two basic conditions: (1) as an alternative way for emergency services in remote locations and (2) it is a better option rather than conventional health services; for example, teleradiology for rural hospitals. It can result in appropriate availability of health services and acceptable efficiency. However, this aspect of medicine was considered in the late 1990, and then, developing countries have a long way for research about it.

Keywords: Technology, Developing Countries, Telemedicine

1. Context

The true merit of telemedicine has yet to be determined by systematic empirical studies (1, 2). Telemedicine is referred to as improper distribution of human and fundamental resources (3). Telemedicine needs more investigation to reveal its advantages and disadvantages (4).

2. Different Applications of Telemedicine

Telemedicine has different applications in medicine. We will define some of them here. In 1974, Gravenstein used laser-mediated telemedicine in anesthesia; consultants evaluated patients and operation room by a color-television monitor and collaborated with anesthesiologists. The Oregon teledermatology project was a 24-hour pediatric echocardiography service by telephone, which was conducted between two general and children hospitals with 500 kilometers distance. The non-

psychiatric physicians can give consultation and education from psychiatrists by closed-circuit television (eg, between Hanover, New Hampshire, and Claremont). It is surprising that primary scientific foundation of telemedicine was in 1950 about X-ray transmission by radio or telephone.

Radiology is one of the developing areas in telemedicine. However, the absence of critical care specialists is a problem, which can be eliminated by telemedicine via two-way audiovisual link between a small private hospital and a large university medical center (eg, San Antonio and South Texas Hospital in Harlingen with 250 miles distance) (5). Telecommunication was used by the National Aeronautics and Space Administration (NASA) for helping disaster victims in 1985 earthquake in Mexico City by Advanced Technology Stellate (6). The European Space Agency (ESA) has started its activations since 1996 and emphasized that satellite communication is a strong technology in providing telemedicine services, especially

in remote areas such as Sub-Saharan Africa. After 1996, the evaluation of telemedicine by stellate communication issues is mandatory for Telemedicine Task Force (TTF) in collaboration with World Health Organization (WHO), the European Commission, and African representatives (7). Telemedicine has some benefits due to providing medical care over distances by phone line, satellite, or internet for people; otherwise, they will have no access to them (8). However, there are minor practical experiences about it (9) because of ambiguous evidence regarding the impact of telemedicine on economic and medical aspects in developing countries (10). Mobile health acts as a useful device for access, coverage of medical problems, and meta-analysis has shown its positive impacts on outcomes of chronic diseases (11). The absence of knowledge about application of technology is one of the obstacles to the extension of telemedicine. Readiness for acceptance of technology, infrastructures, and people is definitely required. In Saudi Arabia, Jordan, Syria, Kuwaiti, Iraq few knowledge is about telemedicine (12). The main disadvantages of telemedicine, especially in coronavirus pandemic, include difficulty to make a diagnosis due to the lack of physical examination and inability to use physician hands-on expertise, the suddenly changed practice due to the COVID-19 pandemic, the remarkable shift to virtual clinics because of the national lockdown and social isolation during the pandemic, the elderly people with restricting technological skills, unawareness of telemedicine as a choice technology and access to services (13). Telemedicine has a considerable role in pain management and care in patients with multiple sclerosis, phantom limb pain, and chronic pain by primary care physicians and psychologists (14). The cost-effectiveness of this approach, particularly in remote and rural regions, is advantageous (15). Latifi et al. concluded that telemedicine is an optimal, continuous, and low cost for rebuilding medical systems in developing countries (16). It is assumed as a problem-solving approach in developing countries. Approximately, 80% of the world's people live in these regions. Telemedicine can be used for clinical, educational, administrative purposes by which educational aspect is more applicable in developing countries. Low-cost clinical telemedicine is possible via email and digital cameras. It is important to note the establishment of telemedicine does not require high financial infrastructures (17). The assessment of 27 referrals showed usefulness and cost-effectiveness in Bangladesh project by digital cameras and tripods (18). One systematic review showed an improved correlation between centers, assistance in ordering, management of drugs, helpful monitoring, and identifying of patients (19). In Peru and Nicaragua rural regions study, the findings demonstrated insufficiency of healthcare. In this regard,

telemedicine can improve this condition (20). It is obvious that rapid development of interesting telemedicine challenges results in healthcare decision-makers rethinking telemedicine infrastructures (21). One pilot study established low-cost telemedicine link is technically easy and has significant benefits in diagnosis, management, and education in developing countries (22). One of the important benefits is to share data and research with other collaborations and consultations about patients' information (23). Advances in communications and IT induce a new vision to secondary and tertiary health-care to people with low socioeconomic levels in India (24). The present investigations result in case innovation approaches for resolving conventional problems (25). Telemedicine provides problem-solving methods in ultra-short duration. Telemedicine mail is written in Java software for telemedicine (26). Approximately only 0.1% of telemedicine demand has been responded to. The correct way will focus on making active networks, which alter health outcomes and provide models for some countries (27). Telemedicine via mobile telephone with camera and digital cameras can be helpful in rural areas (28). TV with space is a low-cost medium. Also, faster internet connections are a way for access to healthcare facilities (29). The health technology by internet (eHealth), such as mobile health, is quickly improving in developing countries and can facilitate communication between patients and healthcare (30). Overall, it was accepted that telemedicine could be provided better healthcare in rural areas, which their hospitals are located in remote places (31). The people who live in rural areas suffer from lower life expectancy and poor health care status (32). A new kit designed with sensor for evaluation of vital signs such as blood pressure, heart rate, and saturation of blood oxygen; then, sends information to mobile application, records and delivers them to a physician. Data are available on USB (33). Beyond successful implementation of telemedicine in health informatics, there are some challenges, especially in developing countries, such as fundamental needs, trained staff, and integrated regional strategies (34). E-readiness is defined as resource and ability to create changes by internet (35). One study showed acceptance of technology and entrance of telemedicine to Iranian hospitals, and the authors have believed that proper educational programs can help extend telemedicine and economic aspects (36). In Iranian survey, awareness of score was 13 ± 5.5 of 35, which means low awareness, 43.7% heard before about teleconsultation, friends, and public media (30.3%) despite this, the clinician staff had positive attention to telemedicine or electronic pathways (37). It seems infrastructures such as internet technology are poor in Iran and with improving it, telemedicine will be a good choice (38).

The surveys in Iran showed that appealing telemedicine does not need funding, trained medicine, and optimal devices (39). Iran is a country with many remote rural areas and naturally, the people cannot receive appropriate medical services due to this reason, especially in winter. Iranian telemedicine association has started its activity since 2016, and the first Iranian telemedicine congress was held in 2017. Authors believe these good steps to a new insight of medicine and support of them can improve our national health status and fair division of medical facility. About 90% of Iran's territory is located in the Iranian plateau and is considered a mountainous country. More than half of the country's land is mountains and highlands, 14 are deserts, and less than 14 are also cultivated lands. Earthquakes are the major vulnerability factor in Iran where approximately 74,000 deaths have occurred as a result of seismic events (40).

3. Conclusions

Here, we brought one example of many remote rural regions in Iran with difficult accessibility to other areas with primary medical resources (Figure 1). Therefore, according to Iran geography and disasters ranking, we will need telemedicine infrastructures for overcoming problems, which may exist on the way of healthcare providing.



Figure 1. Clador " is one of the villages of [East Azarbayejan Province], located in [the village of Kaspereh], [central part of the central city of Calibrat], the central district [Kalibir city]. In the village of Clador, the snowfall reaches one meter in winter (<http://www.kalasoor.ir>).

Footnotes

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References

1. Sood S, Mbarika V, Jugoo S, Dookhy R, Doarn CR, Prakash N, et al. What is telemedicine? A collection of 104 peer-reviewed perspectives and theoretical underpinnings. *Telemed J E Health*. 2007;13(5):573-90.
2. Bashshur RL. On the Definition and Evaluation of Telemedicine. *Telemed J*. 1995;1(1):19-30. doi: [10.1089/tmj.1.1995.1.19](https://doi.org/10.1089/tmj.1.1995.1.19).
3. Sood S, Mbarika V, Jugoo S, Dookhy R, Doarn CR, Prakash N, et al. What is telemedicine? A collection of 104 peer-reviewed perspectives and theoretical underpinnings. *Telemed J E Health*. 2007;13(5):573-90. doi: [10.1089/tmj.2006.0073](https://doi.org/10.1089/tmj.2006.0073). [PubMed: [17999619](https://pubmed.ncbi.nlm.nih.gov/17999619/)].
4. Craig J, Patterson V. Introduction to the practice of telemedicine. *J Telemed Telecare*. 2005;11(1):3-9. doi: [10.1177/1357633X0501100102](https://doi.org/10.1177/1357633X0501100102). [PubMed: [15829036](https://pubmed.ncbi.nlm.nih.gov/15829036/)].
5. Zundel KM. Telemedicine: history, applications, and impact on librarianship. *Bull Med Libr Assoc*. 1996;84(1):71.
6. Garshnek V, Burkle FJ. Applications of telemedicine and telecommunications to disaster medicine: historical and future perspectives. *J Am Med Inform Assoc*. 1999;6(1):26-37. doi: [10.1136/jamia.1999.0060026](https://doi.org/10.1136/jamia.1999.0060026). [PubMed: [9925226](https://pubmed.ncbi.nlm.nih.gov/9925226/)]. [PubMed Central: [PMC61342](https://pubmed.ncbi.nlm.nih.gov/PMC61342/)].
7. Parentela G, Mancini P, Naccarella F, Feng Z, Rinaldi G. Telemedicine, the European Space Agency, and the Support to the African Population for Infectious Disease Problems. *Telehealth Networks for Hospital Services*. IGI Global; 2013. p. 89-96. doi: [10.4018/978-1-4666-2979-0.ch005](https://doi.org/10.4018/978-1-4666-2979-0.ch005).
8. Edworthy SM. Telemedicine in developing countries may have more impact than in developed countries. *BMJ*. 2001;323(7312):524-5. doi: [10.1136/bmj.323.7312.524](https://doi.org/10.1136/bmj.323.7312.524). [PubMed: [11546681](https://pubmed.ncbi.nlm.nih.gov/11546681/)]. [PubMed Central: [PMC121115](https://pubmed.ncbi.nlm.nih.gov/PMC121115/)].
9. Wootton R. The possible use of telemedicine in developing countries. *J Telemed Telecare*. 1997;3(1):23-6. doi: [10.1258/1357633971930157](https://doi.org/10.1258/1357633971930157). [PubMed: [9139757](https://pubmed.ncbi.nlm.nih.gov/9139757/)].
10. Khanal S, Burgon J, Leonard S, Griffiths M, Eddowes LA. Recommendations for the Improved Effectiveness and Reporting of Telemedicine Programs in Developing Countries: Results of a Systematic Literature Review. *Telemed J E Health*. 2015;21(11):903-15. doi: [10.1089/tmj.2014.0194](https://doi.org/10.1089/tmj.2014.0194). [PubMed: [26103465](https://pubmed.ncbi.nlm.nih.gov/26103465/)].
11. Beratarrechea A, Lee AG, Willner JM, Jahangir E, Ciapponi A, Rubinstein A. The impact of mobile health interventions on chronic disease outcomes in developing countries: a systematic review. *Telemed J E Health*. 2014;20(1):75-82. doi: [10.1089/tmj.2012.0328](https://doi.org/10.1089/tmj.2012.0328). [PubMed: [24205809](https://pubmed.ncbi.nlm.nih.gov/24205809/)]. [PubMed Central: [PMC388011](https://pubmed.ncbi.nlm.nih.gov/PMC388011/)].
12. Musa Jaber M, Abd Ghani MK, Suryana Herman N. A review of adoption of telemedicine in middle east countries: Toward building Iraqi telemedicine framework. *Science International*. 2014;26(5).
13. Mubarak AA, Alrabie AD, Sibyani AK, Aljuaid RS, Bajaber AS, Mubarak MA. Advantages and disadvantages of telemedicine during the COVID-19 pandemic era among physicians in Taif, Saudi Arabia. *Saudi Med J*. 2021;42(1):110.
14. Hanna GM, Fishman I, Edwards DA, Shen S, Kram C, Liu X, et al. Development and patient satisfaction of a new telemedicine service for pain management at Massachusetts General Hospital to the Island of Martha's Vineyard. *Pain Medicine*. 2016;17(9):1658-63.
15. Laouyane A. Telemedicine and developing countries. *J Telemed Telecare*. 2016;4(2_suppl):1-88. doi: [10.1258/1357633981932064](https://doi.org/10.1258/1357633981932064).
16. Latifi R, Dasho E, Shatri Z, Tilley E, Osmani KL, Doarn CR, et al. Telemedicine as an innovative model for rebuilding medical systems in developing countries through multipartnership collabora-

- tion: the case of Albania. *Telemed J E Health*. 2015;**21**(6):503–9. doi: [10.1089/tmj.2014.0138](https://doi.org/10.1089/tmj.2014.0138). [PubMed: [25347524](https://pubmed.ncbi.nlm.nih.gov/25347524/)].
17. Wootton R. Telemedicine and developing countries—successful implementation will require a shared approach. *J Telemed Telecare*. 2001;**7** Suppl 1:1–6. doi: [10.1177/1357633X010070S101](https://doi.org/10.1177/1357633X010070S101). [PubMed: [11576471](https://pubmed.ncbi.nlm.nih.gov/11576471/)].
 18. Vassallo DJ, Hoque F, Roberts MF, Patterson V, Swinfen P, Swinfen R. An evaluation of the first year's experience with a low-cost telemedicine link in Bangladesh. *J Telemed Telecare*. 2001;**7**(3):125–38. doi: [10.1258/1357633011936273](https://doi.org/10.1258/1357633011936273). [PubMed: [11346472](https://pubmed.ncbi.nlm.nih.gov/11346472/)].
 19. Blaya JA, Fraser HS, Holt B. E-health technologies show promise in developing countries. *Health Aff (Millwood)*. 2010;**29**(2):244–51. doi: [10.1377/hlthaff.2009.0894](https://doi.org/10.1377/hlthaff.2009.0894). [PubMed: [20348068](https://pubmed.ncbi.nlm.nih.gov/20348068/)].
 20. Martinez A, Villarreal V, Seoane J, del Pozo F. Analysis of information and communication needs in rural primary health care in developing countries. *IEEE Trans Inf Technol Biomed*. 2005;**9**(1):66–72. doi: [10.1109/titb.2004.842411](https://doi.org/10.1109/titb.2004.842411). [PubMed: [15787009](https://pubmed.ncbi.nlm.nih.gov/15787009/)].
 21. Wright D, Androuchko L. Telemedicine and developing countries. *J Telemed Telecare*. 1996;**2**(2):63–70. doi: [10.1177/1357633X9600200201](https://doi.org/10.1177/1357633X9600200201). [PubMed: [9375065](https://pubmed.ncbi.nlm.nih.gov/9375065/)].
 22. Graham LE, Zimmerman M, Vassallo DJ, Patterson V, Swinfen P, Swinfen R, et al. Telemedicine—the way ahead for medicine in the developing world. *Trop Doct*. 2003;**33**(1):36–8. doi: [10.1177/004947550303300118](https://doi.org/10.1177/004947550303300118). [PubMed: [12568520](https://pubmed.ncbi.nlm.nih.gov/12568520/)].
 23. Mitka M. Developing countries find telemedicine forges links to more care and research. *JAMA*. 1998;**280**(15):1295–6. doi: [10.1001/jama.280.15.1295](https://doi.org/10.1001/jama.280.15.1295). [PubMed: [9794294](https://pubmed.ncbi.nlm.nih.gov/9794294/)].
 24. Ganapathy K. Telemedicine and neurosciences in developing countries. *Surg Neurol*. 2002;**58**(6):388–94. doi: [10.1016/s0090-3019\(02\)00924-2](https://doi.org/10.1016/s0090-3019(02)00924-2).
 25. World Health Organization. *Telemedicine: opportunities and developments in member states. Report on the second global survey on eHealth*. World Health Organization; 2010.
 26. Fraser HS, Jazayeri D, Nevil P, Karacaoglu Y, Farmer PE, Lyon E, et al. An information system and medical record to support HIV treatment in rural Haiti. *BMJ*. 2004;**329**(7475):1142–6. doi: [10.1136/bmj.329.7475.1142](https://doi.org/10.1136/bmj.329.7475.1142). [PubMed: [15539669](https://pubmed.ncbi.nlm.nih.gov/15539669/)]. [PubMed Central: [PMC527691](https://pubmed.ncbi.nlm.nih.gov/PMC527691/)].
 27. Wootton R, Craig J, Patterson V. *Introduction to telemedicine*. 2nd. CRC Press; 2006. 226 p.
 28. Bashshur RL. Chapter 1: Telemedicine and Health Care. *Telemed J E Health*. 2002;**8**(1):5–12. doi: [10.1089/15305620252933365](https://doi.org/10.1089/15305620252933365). [PubMed: [12020402](https://pubmed.ncbi.nlm.nih.gov/12020402/)].
 29. Blesik T, Bick M. Adoption Factors for Crowdsourcing Based Medical Information Platforms. *Knowledge Science, Engineering and Management*. Springer; 2016. p. 172–84.
 30. Qureshi NA, Kundi GM, Qureshi QA, Akhtar R, Hussain L. An investigation into the adoption and use issues of E-health in public sector hospitals of developing countries. *Mediterr J Med Sci*. 2015;**2**(1).
 31. Wootton R, Bonnardot L. In what circumstances is telemedicine appropriate in the developing world? *JRSM Short Rep*. 2010;**1**(5):1–11. doi: [10.1258/shorts.2010.010045](https://doi.org/10.1258/shorts.2010.010045). [PubMed: [21103129](https://pubmed.ncbi.nlm.nih.gov/21103129/)]. [PubMed Central: [PMC2984368](https://pubmed.ncbi.nlm.nih.gov/PMC2984368/)].
 32. Strasser R, Kam SM, Regalado SM. Rural Health Care Access and Policy in Developing Countries. *Annu Rev Public Health*. 2016;**37**:395–412. doi: [10.1146/annurev-publhealth-032315-021507](https://doi.org/10.1146/annurev-publhealth-032315-021507). [PubMed: [26735432](https://pubmed.ncbi.nlm.nih.gov/26735432/)].
 33. Bird J, McAuley T, McMahon C. *Vital sensory kit for use with telemedicine in developing countries*. Santa Clara University; 2016.
 34. Luna D, Almerares A, Mayan JC, Gonzalez Bernaldo de Quiros F, Otero C. Health Informatics in Developing Countries: Going beyond Pilot Practices to Sustainable Implementations: A Review of the Current Challenges. *Healthc Inform Res*. 2014;**20**(1):3–10. doi: [10.4258/hir.2014.20.13](https://doi.org/10.4258/hir.2014.20.13). [PubMed: [24627813](https://pubmed.ncbi.nlm.nih.gov/24627813/)]. [PubMed Central: [PMC3950262](https://pubmed.ncbi.nlm.nih.gov/PMC3950262/)].
 35. Qureshi QA, Qureshi NA, Khan S, Chishti KA, Kundi GM, Akhtar R. E-Readiness: a critical factor for successful implementation of Ehealth projects in developing countries like Pakistan. *Gomal Uni J Res*. 2014;**30**(2):77–86.
 36. Miandoab AT, Alizadeh G, Rezaei P. 148: The study of specialist physician knowledge and attitude of telemedicine and barriers to its implementation in Tabriz teaching hospitals. *BMJ Open*. 2017. doi: [10.1136/bmjopen-2016-015415.148](https://doi.org/10.1136/bmjopen-2016-015415.148).
 37. Sheikhtaheri A, Sarbaz M, Kimiafar K, Ghayour M, Rahmani S. Awareness, attitude and readiness of in Mashhad, Iran. Exploring complexity in health: An interdisciplinary systems approach. *Proc MIE2016*. 2016;**228**:142.
 38. Salehahmadi Z, Hajialiasghari F. Telemedicine in Iran: chances and challenges. *World J Plast Surg*. 2013;**2**(1):18.
 39. Goodarzi M, Torabi M, Safdari R, Dargahi H, Naeimi S. Innovation Network Development Model in Telemedicine: A Change in Participation. *Healthc Inform Res*. 2015;**21**(4):265–70. doi: [10.4258/hir.2015.21.4.265](https://doi.org/10.4258/hir.2015.21.4.265). [PubMed: [26618033](https://pubmed.ncbi.nlm.nih.gov/26618033/)]. [PubMed Central: [PMC4659884](https://pubmed.ncbi.nlm.nih.gov/PMC4659884/)].
 40. Peduzzi P, Dao H, Herold C, Mouton F. Assessing global exposure and vulnerability towards natural hazards: the Disaster Risk Index. *Nat Hazards Earth Syst Sci*. 2009;**9**(4):1149–59. doi: [10.5194/nhess-9-1149-2009](https://doi.org/10.5194/nhess-9-1149-2009).