Telemedicine – Meaning, Challenges and Opportunities

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ABSTRACT

Medical service is one of the crucial policies and decent medical service is required by the population in every country. There are three main obstacles which prevent people from obtaining proper medical cares and treatments. First, the deficiency of medical staffs especially physicians which occur even in the developed countries. Second, regarding an important demographic issue, an increase in the number of the elderly makes the medical services more demanding. Finally, geographical aspect also plays a major role in healthcare inequality. The population dwelling in rural or remote areas struggle from accessing proper medical services. Information and communication technologies have become an important infrastructure upon which several domains can build in order to achieve more effective solutions. Integrating such technologies into the medical discipline results in telemedicine which is currently available across the globe. This article describes telemedicine in three key aspects including current state, challenges and opportunities based upon existing studies and implementations.

Keywords: Health monitoring; telehealth; telemedicine (Siriraj Med J 2019;71: 246-252)

INTRODUCTION

Population has been regarded as the most valuable asset in every country. Apart from several aspects such as education, health-related issues are crucially responsible for the governmental agencies in order to provide proper medical services. There are many obstacles to achieving such goals including economic, demographic and geographical points of view. Deficiency of qualified medical staff significantly causes uncovered medical services, especially in the developing areas. In the global point of view, according to the currently reported density of physicians defined as a total number per ten thousand population, all of the countries have such ratios which are lower than 60.[1] Most of the African countries have the ratios which are lower than 5. On the other hand, countries in Europe and in North America have higher ratios. However, higher ratio does not demonstrate an equivalent access to the medical services in all areas. People dwelling in rural areas experience several difficulties in obtaining the same services compared to those living in urban areas.

Such problem has been worsened by an ongoing aging society transformation. The elderly require medical monitoring and warning system in order to avoid feasible injuries and losses. According to the report conducted by the United Nations[2], some key findings have been concluded as follows:

- The number of people aged 60 years or over is projected to grow by 56 percent between 2015 and 2030 and will be double or approximately 2.1 billion by the year 2050.
- According to the prediction, the number of people aged 60 years or over is expected to increase fastest in Latin America and the Caribbean (71 percent), followed by Asia (66 percent),

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Africa (64 percent), Oceania (47 percent), Northern America (41 percent) and Europe (23 percent).
- The ratio of the elderly aged 80 years or over is predicted to increase from 14 percent in 2015 to over 20 percent in 2050.
- Aging society transformation is occurring faster in urban areas than in rural areas.
- The growth of aging society in many developing countries is currently faster than that occurred in developed countries.

Both requirements on deficiency of medical personnel and aging society transformation can be realized as a key driver on leveraging health and well-being strategies in order to provide decent and proper medical services to the whole population.

Computer hardware and software technologies have been playing a major role in introducing automated systems from which several domains such as medical aspect can benefit from. Several benefits include increasing operation reliability, accuracy and efficiency, which results from the computer system. Furthermore, communication technologies tackle the services which mainly rely on the physical distances and other environmental impacts. People in the rural or difficult areas are thus able to access medical services.

Leveraging computer-related technologies onto medical disciplines has been conducted and the outcome was initially one part of the "Health Telematics". An international Group Consultation on World Health Organization (WHO)'s Telemedicine Policy in relation to the Development of the Health-for-All Strategy in the 21st Century was established and assembled in 1997. The definition of telemedicine is accordingly proposed as follows.[3]

"Telemedicine is the delivery of health care services, where distance is a critical factor, by all health care professionals using information and communications 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."

Telemedicine can be determined as an integration of several components including information and communication technologies, hardware and software technologies and medical services operating together in order to provide required features or services to users as shown in Fig 1. The underlying technologies are seen as a black box to the users and they are responsible for facilitating processes of each proposed service.

Information and communication technologies have been regarded as a key infrastructure for facilitating data exchange among relevant parties located at different locations. Several domains deploy both technologies in order to make their services more accessible. With recent advancement in hardware and software technologies,

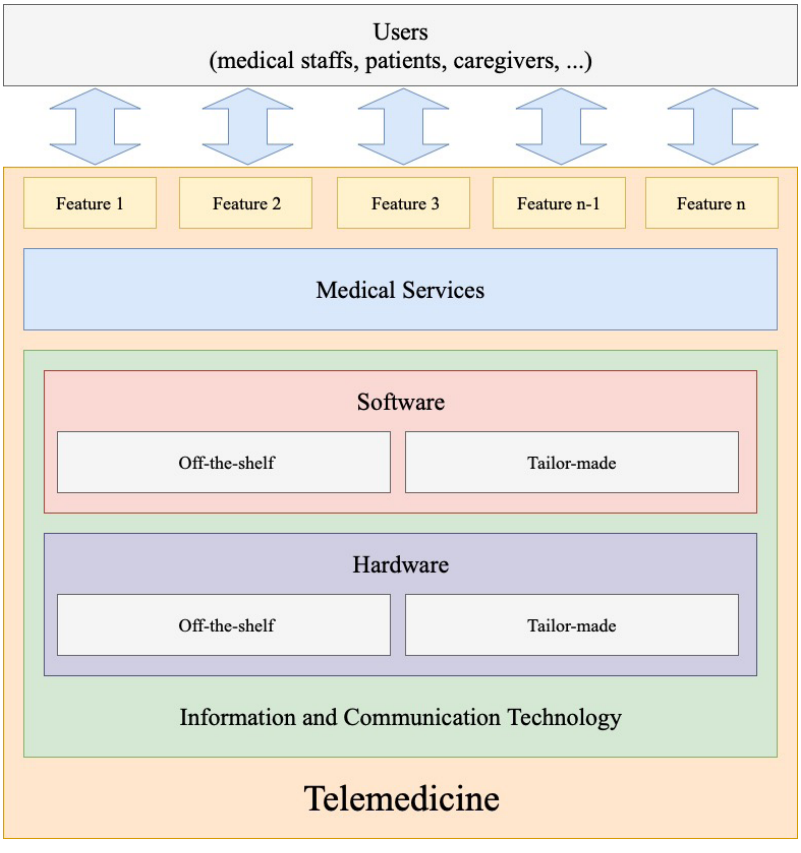

Fig 1. Concept of telemedicine which consists of several components. Medical services deploy digital technology to provide more efficient services regardless of distance and time. Information and communication technologies play a major role as an underlying infrastructure. Hardware and software technologies can be considered as a medical service provider via several features. The technologies are black box to users.

multimedia can be delivered via the Internet in real-time. Such breakthrough enables the communications between physicians or medical staff and patients or their family members. Preliminary diagnosis and corresponding medical consultancy can be performed and delivered. Hence, the patients do not always need to personally meet their physicians.

Apart from tackling distance limitation by communication technology, a computerized system is implemented and deployed in order to facilitate operational procedures. Several components are developed and work together. For example, mobile or web applications consisting of several features are developed for both physician and patient sides. Captured photos by the patients via their mobiles are stored in the database server and retrieved later by the physicians. In case of emergency, the medical staff interrogate the patients or the caregivers through the applications, then diagnose and provide first-aid suggestions online. Furthermore, telemedicine can be used as a learning tool where the physicians around the globe discuss and exchange their opinions. Both distance and time limitations are therefore overcome by telemedicine.

This article focuses on the telemedicine regarding as an application of information and communication technologies to the medical disciplines. Key issues including its challenges and opportunities based upon existing case studies are addressed. The remaining parts of this article are organized as follows: current state of telemedicine focusing on aging society is given in Section 2. Section 3 outlines key challenging issues on telemedicine based upon existing applications. Several opportunities of telemedicine system deployment are addressed in Section 4. Finally, conclusions are provided in Section 5.

Current state of telemedicine

Telemedicine is regarded as an integration of medical services and information and communication technologies. Underlying computer-based technologies can be pictured as medical service delivery channels. Hence, several existing medical services benefit from such technologies in order to tackle various limitations. This section focuses on addressing current state of telemedicine application, especially to aging society domain.

Telemedicine has been deployed or of interest in many regions including developed countries[4] and developing countries.[5,6] A wide range of medical services is currently provided via telemedicine such as telelaboratory service, telehealth education and ambulance.[7] The elderly normally experience several common health issues such as chronic health conditions, cognitive health and mental health which make ability to move or travel to hospital become more difficult, impractical or sometimes impossible. The elderly have become one of the major target groups for telemedicine. Remote medical diagnosis, care and treatment can be performed at the elderly's houses or nearby hospitals via telemedicine. Not only providing remote medical services, telemedicine also gives the elderly a feeling of reassurance and safety.[8]

A study based upon in-depth review and interview outlines current state and future trends in telemedicine application to aging society in Europe.[4] According to the findings, both devices and their associate services are categorized into several generations. Basic services using ordinary sensors such as alarm system including safety and security monitoring[8] are in the first generation whereas detectors and tracking devices are in the second generation. More advanced devices which use more than one technology and provide additional functions are in the third generation. More complex services such as monitoring, consultation, diagnostic and tele-education are found in the third generation. Furthermore, key trends include medical services based upon mobile devices, personal digital assistants, interactions between devices and prediction.

Like other countries, Thailand is transforming into an aging society. According to the latest information, current ratio of the population aged 60 or over is approximately 17%.[9] Moreover, in 2017, a physician and a nurse are responsible for taking care of 1,843 and 405 Thai people, respectively.[10] In order to increase an opportunity for Thai people for obtaining medical and health services with equality, eHealth strategy for 2017 – 2026 is outlined by the Ministry of Public Health.[11] Regarding the strategy, eHealth development in Thailand has four phases as follows:

- Investing and building a foundation for eHealth development phase which is planned to take 1 year and 6 months.
- eHealth inclusion phase aims at involving all sector of Thailand to eHealth operations. This phase is planned to spend 5 years.
- eHealth transformation phase aims to leverage digital innovation to propose innovative medical services. It is estimated to take 10 years to achieve such goal.
- eHealth leadership phase to creating real economic value in public health system and to provide good quality of life to Thai people. This big step will take 20 years.

Even telehealth or telemedicine is also one of the focused components as described in the strategy, it requires

underlying information and communication technologies for delivering reliable medical services. eHealth foundations are essential and thus firstly operated. Furthermore, several plans for developing eHealth applications are based upon the survey conducted in 2009. In case of telemedicine, major barriers to implementing solutions include lack of legal policies/regulation, organizational culture not supportive, competing priorities, lack of knowledge of applications and lack of technical expertise. In summary, four information is required to support telemedicine development including cost, infrastructure, legal and ethical issues and patients' perception.

There are two approaches to implementing telemedicine. The first one is to join the existing communities. Thailand has been associated with the Telemedicine Development Center of Asia (TEMDEC) since 2005. The first hospital that joined telemedicine program is Siriraj Hospital. As of 2017, in total 144 programs have been recently conducted in Thailand. Moreover, most of the program associations are conducted in Bangkok. Endoscopy and surgery are the two main activities which performed via telemedicine.[12] The other scheme is building our own system. Even eHealth foundations development is in progress, over 30 applications have been built by the Ministry of Public Health and launched for public use. Most of them provide useful health-related information such as first aid, medical institutions and diseases.[13]

Challenges

Telemedicine has been recently deployed in many countries both developed and developing ones. Like other system applications, several challenges have been arisen and they are outlined in this section. In total 5 key issues based upon economic, technological and social sides together with some existing studies are described.

- System Development Cost – Apart from the required medical issues, enabling the population especially those dwell in remote or developing areas to benefit from the information and communication technologies generates additional costs. Such requirement can be considered as a key policy in the 21st century[3] and it needs to be driven by the government.[11] Both technologies are core infrastructure and a large amount of budget is required to invest in necessary computer equipment and developing tools.[8] Hardware and software installation and maintenance together with qualified manpower and knowledge transfer demonstrate one-time and periodic investment.
- System Implementation – Several parties within and across institutes are involved in an implementation of telemedicine services.[11] Like other domains, telemedicine implementation is not only technological but also managerial prospects. Prior to implementing a telemedicine project, several issues including technological and societal aspects have to be carefully considered.[8] As telemedicine services are built upon existing digital technologies, developing teams are normally required to understand the underlying infrastructure and the users' requirements. Advancement in digital technologies including hardware and software has been occurring and they are utilized for transformation in several domains in order to yield better solutions and competitive advantages. Developing tools and devices have been created and continuously improved to conform to the latest advancement. The system developers are always expected to properly select and use the tools and the devices in order to develop the next generation of telemedicine solutions which conform to the requirements.[4] Moreover, obtaining precise requirements are challenging as they need proper communication and collaboration skills between groups of people with different expertise and background. Telemedicine affects traditional medical care processes and several social concerns may arise. Key concerns including legal, regulatory, security and human resources issues together with successful implementation of the telemedicine services are addressed.[11,14] Building a telemedicine service is therefore not only about completing the system implementation but also about the impacts of system utilization.
- Digital Literacy – This issue mostly affects the elderly as they were born before the "digital disruption" age where most systems or services are integrated with the digital technology. Unlike the following generations that digital technology has become one of the major parts of their lives, the elderly has to learn how to use some devices such as smartphone and interact with applications such as health technology-based applications. Results show that the users aged over 65 years old produce lower success rate and higher error on assigned computer-based tasks compared to the younger ones.[8] Several studies on technology acceptance by the elderly including stakeholders' perspectives, factors influencing technology and dynamics in technology have been conducted.[15]

According to survey on digital technology usage, 71 percent of the elderly aged over 65 years access the Internet every day or almost every day.[16] Moreover, 27 and 18 percent of them own tablet or e-book reader and smartphone, respectively. Telemedicine service may build upon some existing applications or has its own applications. Therefore, the user uses its services via several devices.

- Digital Technology Acceptance – Even digital technology has been integrated to many activities in our daily lives, some people including the elderly still do not accept it regarding several issues such as privacy and security.[8,11] A large number of firms such as banks are developing their own financial services on web or mobile applications in order to decrease operation costs. Several campaigns or privileges are offered to persuade their customers to go online. However, different realization may be observed in the healthcare domain. First, health-related personal data is required to be securely transmitted over digital networks and accurately destined to predefined receivers. Second, additional devices such as wearable devices capable of measuring heart rate or blood pressure are deployed to sense and transmitted the measurements to the receiving nodes. Such devices' performance especially their accuracy compared to standard medical equipment is one of the major concerns. Scope of the offering telemedicine services should thus be concisely defined for the users' accurate understandings.[4,8] Under some circumstances, telemedicine can be used as a monitoring tool for early detection and warning.[4] Hence, devices available in the market can be used. Results indicate acceptance of telemedicine to improve quality of care in rural areas and during emergency situations.[17]
- Diagnostic Accuracy – Accuracy of the diagnosis is one of the key concerns especially when the physicians and the patients are at different locations. Face-to-face medical care usually brings confidence to patients, especially the elderly.[8] However, a short period of medical interrogation and vital sign measurement performed at a hospital may not reflect current symptoms due to the white coat syndrome.[18] Physicians may obtain more accurate results by applying continuous health monitoring based upon electronic healthcare approach. Several studies have been undertaken in order to investigate the diagnostic accuracy of the telemedicine applied to the emergency department and ophthalmology.[19,20] The results demonstrate telemedicine as a viable alternative to the in-person and a valuable tool where medical service is in high demand.

Opportunities

Most countries have been experiencing deficiency of physicians and aging society transformation. Population dwelling in remote or developing areas tends to have lower opportunities of decent medical care than those residing in an urban or developed areas. Such limitations worsen the situations especially in an emergency where urgent help is needed. Telemedicine can be used to deliver medical services regardless of distance and time via information and communication technologies. Several studies and reviews of applying telemedicine in developing countries have been undertaken.[21-24] This section outlines feasible opportunities of telemedicine.

- Cost Reduction – One of the main objectives of digital technology integration is to provide better services at lower cost. In case of telemedicine, several operation costs such as traveling can be reduced as the patients are able to get medical services online. Several results indicate cost effectiveness of telemedicine compared to other methods.[25-27] Telemedicine can thus be considered as an alternative diagnosis and treatment methods in several cases. For example, it can be used for the first diagnosis or an emergency to provide an urgent help. Moreover, hospitals benefit from applying telemedicine. Hospital bed or space occupancy and resource utilization can be improved as patients receive medical cares at any places and anytime.
- Preventive Medicine Promotion – People sometimes have symptoms which can be prevented. One of the key benefits of practicing preventive medicine is to decrease feasible illnesses. It can be conducted by several levels ranging from the governmental agencies to individuals.[28] Health monitoring concept together with telemedicine are the main driver of applying preventive medicine. In order to obtain the real-time vital sign readings, wearable devices available in the market can be used to sense and transmit the readings to the medical staff.[29] Preliminary diagnosis and following procedures are performed by using telemedicine. Possible illnesses can thus be prevented or found at an early stage.
- Medical Education – Most countries are still

experiencing the lack of medical staff and specialists. Remote areas do not have professionals to provide specific medical cares or treatments. Such problems are worsened in case of emergency. Apart from being a medical treatment platform, telemedicine can be used as a continuing medical education where medical staff and professionals meet, learn and exchange their knowledge and experiences. Successful cases of telemedicine as an education platform are reported.[30,31] Sessions can be conducted at any convenient sites where attendees gather and participate an assigned workshop.

- Healthcare Equality – Limitations of distance and time are tackled by the information and communication technologies. Telemedicine is built on top of such technologies in order to provide medical services. People around the world can therefore access the services as soon as they are connected to the Internet. Medical services are not only delivered by local physicians. Professionals residing at other areas can provide diagnoses and treatments. Local or novice physicians are capable of learning from medical specialists. In order to achieve healthcare equality, collaboration, regulation and standardization are required. Governmental agencies and private institutes have to cooperate and agree upon a set of requirements. Regarding the digital technologies related issues, several predefined standards such as communication protocols can be adopted.
- Service Diversity – With an advancement of recent digital technology, data delivery and processing are considerably improved. Instead of basic data type, multimedia streaming over the Internet is now more efficient. Processing power is also remarkably increased while the hardware price is continually decreased. Such improvements support a variety of medical services and enable real-time applications. A variety of telemedicine services such as tele-pathology, tele-dermatology, tele-nursing and tele-surgery and their performance acceptance are addressed.[32] The key consideration on offering new service is to select a set of suitable tools and technologies.

CONCLUSION

Two major indices reflecting good quality of life are healthiness and access to decent medical services. Lack of medical personnel, demographical and geographical problems are significant barriers of medical service improvement. Telemedicine can be applied to aging society transformation which causes higher demand of remote medical care and treatment. Telemedicine is officially defined by the World Health Organization (WHO) as the delivery of health care services where distance is a critical factor. Major challenges of telemedicine utilization include system development cost, system implementation, digital literacy, digital technology acceptance and diagnostic accuracy. Building a telemedicine service requires information and communication technologies as the underlying infrastructure. System integration needs some specialists who can address users' requirements and develop the required system. Users' acceptance of technology is crucial to acquiring the advantages of telemedicine. A revision of generated results is essential in order to avoid diagnostic errors. Several opportunities of telemedicine include cost reduction, preventive medicine promotion, medical education, healthcare equality and service diversity. Studies show that telemedicine significantly reduces cost of treatment as hospital visit is no longer necessary. Regarding cost issues, not only the patients but also the medical institutes benefit from telemedicine. Moreover, telemedicine facilitates health monitoring and thus promotes preventive medicine. Knowledge and experience transfer and exchange are feasible via telemedicine. Medical personnel and corresponding services are thus improved, and it is possible for the population to have an equality in medical services. Finally, a variety of medical services is observed, and additional services can be offered due to technological advancement.

Telemedicine has been realized by many countries as major tool to delivering decent and improved medical services with equality. It is therefore included in national healthcare strategies outlined by several nations. In order to achieve the same operating standards, all of the relevant parties have to involve and make agreements. Telemedicine consists of several systems connected by universally pre-defined data formats and protocols. Making all medical institutes follow such formats will definitely be time-consuming as some of them have their own formats. Standard protocols have to be also applied. Hence, telemedicine is not only building the new system but also adjusting the legacy systems. Apart from technological issue, several aspects must be taken into consideration including economical and societal ones. Inaccurate diagnosis and personal data leakage lead to legal and ethical issues. Proper preparation and operating procedures are significantly required to successfully apply telemedicine.

REFERENCES

1. Who.int [Internet].Global health observatory data repository – medical doctors [updated 2017; cited 2019Apr14] Available from http://apps.who.int/gho/data/node.main HWFGRP_0020?lang=en.
2. Un.org [Internet]. World population ageing [updated 2015; cited 2019 Apr 13]. Available from http://www.un.org/en/development/desa/population/publications/pdf/ageing/ WPA2015_Report.pdf.
3. Who.int [Internet]. A health telematics policy [updated 1997; cited 2019 Apr 13]. Available from http://apps.who.int/iris/bitstream/handle/10665/63857/WHO_DGO_98.1.pdf?sequence=1&isAllowed=y.
4. Pacitaproject.eu [Internet]. Telecare technology for an ageing society in Europe – current state and future developments [updated 2013; cited 2019 Apr 13]. Available from http://www.pacitaproject.eu/wp-content/uploads/2012/11/Telecare-description-web.pdf.
5. Ganapathy K, Chawdhry V, Premanand S, Sarma A, Chandralekha J, Kumar KY, et al. Telemedicine in the Himalayas: operational challenges – a preliminary report. Telemed J E Health. 2016;22:821-35.
6. Chandwani RK, Dwivedi YK. Telemedicine in India: current state, challenges and opportunities, Transforming Government: People. Process and Policy. 2015;9:393-400.
7. Rogers H, Madathil KC, Agnisarman S, Narasimha S, Ashok A, Nair A, et al. A systematic review of the implementation challenges of telemedicine systems in ambulances. Telemed J E Health. 2017;23:707-17.
8. Bujnowska-Fedal MM, Grata-Borkowska U. Use of telemedicine-based care for the aging and elderly: promises and pitfalls. Smart Homecare Technology and TeleHealth. 2015;8:91-105.
9. Thailandometers.mahidol.ac.th [Internet]. Thailandometers [updated 2019 Apr 12; cited 2019 Apr 12]. Available from http://www.thailandometers.mahidol.ac.th.
10. Social.nesdb.go.th [Internet]. The number of Thai populations per medical staff 1994 – 2017 [updated 2018 Nov 5; cited 2019 Apr 13] Available from http://social.nesdb.go.th/ SocialStat/StatReport_Final.aspx?reportid=662&template=1R2C&yeartype=M&subcatid=18
11. Moph.go.th [Internet]. eHealth strategy 2017 – 2026 [updated 2017 Aug; cited 2019 Apr 13] Available from https://ehealth.moph.go.th/index.php/resources/draft-ehealth-strategy-ministry-of-public-health-2016-2021?download=7:eng.
12. Shimizu S, Kudo K, Tomimatsu S, Moriyama T, Moriyama T, Sadakari Y, et al. International telemedicine activities in Thailand. Siriraj Med J. 2018;70:471-5.
13. Moph.go.th [Internet]. MoPH Application [cited 2019 Apr 10]. Available form https://www.moph.go.th/index.php/home/app_moph.
14. Paho.org [Internet]. Framework for the implementation of a telemedicine service [updated 2016; cited 2019 Apr 13]. Available fromhttp://iris.paho.org/xmlui/bitstream/handle/123456789/28414/9789275119037_eng.pdf;sequence=1.
15. Sebastian Peek. Understanding technology acceptance by older adults who are aging in place: a dynamic perspective, Ph.D. Thesis, Tilburg University, 2017.
16. Pewresearch.org [Internet]. Older adults and technology use [updated 2014; cited 2019 Apr 13]. Available from http://www.pewresearch.org/wp-content/uploads/sites/9/ 2014/04/PIP_Seniors-and-Tech-Use_040314.pdf.
17. Thomas GP, Christian AB, Suzanne KP, Renald L. Social acceptance and population confidence in telehealth in Quebec. B MC Health Services Research. 2015;15:72.
18. Briana C, Kelly H-Zolnierek, Krista H. White coat hypertension: improving the patient-health care practitioner relationship, Phychol Res Behav Manag. 2015;8:133-41.
19. Izzo JA, Bhat R, Blumenthal J, Hoffman D, Watson J, et al. Diagnostic accuracy of a rapid telemedicine encounter in the emergency department. Ann Emerg Med. 2017; 70(4):S127-S128.
20. Ausayakhun S, Skalet AH, Jirawison C, Keenan JD, Khouri C, Nguyen K, et al. Accuracy and reliability of telemedicine for diagnosis of cytomegalovirus retinitis. Am J Ophthalmol. 2011; 152:1053-8.
21. Carlo C, Gabriele P, Giuseppe P. Telemedicine for developing countries – a survey and some design issues. ApplClin Inform. 2016;7:1025-50.
22. Who.int [Internet]. Telemedicine – Opportunities and developments in member states [updated 2010; cited 2019 Apr 13]. Available from http://www.who.int/goe/publications /goe_telemedicine_2010.pdf.
23. Aparajita D, Soumya D. Telemedicine: a new horizon in public health in India. Indian J Community Med. 2008;33:3-8.
24. Richard W, Nivritti GP, Richard ES. Telehealth in the developing world. Royal Society of Medicine Press Ltd. London; 2009.
25. Connectwithcare.org [Internet]. Assessment of the feasibility and cost of replacing in-person care with acute care telehealth services [updated 2014; cited 2019 Apr 13]. Available from http://www.connectwithcare.org/wp-content/uploads/2014/12/Medicare-Acute-Care-Telehealth-Feasibility.pdf.
26. Agha Z, Schapira RM, Maker AH. Cost effectiveness of telemedicine for the delivery of outpatient pulmonary care to a rural population. Telemed J E Health. 2002;8:281-91.
27. Stensland J, Speedie SM, Ideker M, House J, Thompson T. The relative cost of outpatient telemedicine services. Telemed J. 1999;5:245-56.
28. Clarke EA. What is preventive medicine? Can Fam Physician. 1974;20:65-68.
29. Leelaloetphanit W, Leelaloetphanit W, Srikhuanjai K, Chomanan P, Khemapech I. UbiNurSS on Mobile: a ubiquitous nursing support system on mobile devices, Proceedings of the 5th IIAI International Congress on Advanced Applied Informatics. 2016.p.71-76.
30. Randriambelonoro M, Bagayoko CO, Geissbuhler A. Telemedicine as a tool for medical education: a 15-year journey inside the RAFT network. Ann N Y Acad Sci. 2018;1434:333-341.
31. Michael AER, Michael PC, Peter WC, Mary G. The use of telemedicine for delivering continuing medical education in rural communities. Telemedicine and e-Health. 2005; 11:124-9.
32. Hassibian MR, Hassibian S. Telemedicine Acceptance and Implementation in Developing Countries: Benefits, Categories, and Barriers. Razavi International Journal of Medicine [Internet]. Kowsar Medical Institute; 2016 Aug 21 [cited 2019 Apr 13];4(3). Available from: http://dx.doi.org/10.17795/rijm38332.