TELEMEDICINE FOR THE RURAL AREAS IN ASEAN : THE CHALLENGES AND OPPORTUNITIES

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Abstract

Information and communication technology (ICT) is one of the main solutions that occur in every country, both developing and developed countries. One of the use ICT in the field of affordable health care at a cost effective without forgetting the quality, in the other hand it can be accessed by people from various groups. Telemedicine is one form of ICT that is used to overcome geographic barriers and improve access to health care. Telemedicine as a new breakthrough in the field of health technology can be via e-mail, voice or visual. Telemedicine can cover a variety of things ranging from very common and can include diagnosis and management, faculty, patients and the general population and administrative meetings. ASEAN is a region consisting of several developing countries that have considerable health problems. Telemedicine opportunities can be seen from the benefits of helping to monitor the health of the region, which like the Philippines and Indonesia is an archipelagic country that will benefit from telemedicine as it can facilitate remote monitoring and consultation. however, the challenges faced are also severe as they will be subject to limited technological and information facilities in rural areas as well as resources that have not been able to use telemedicine. But telemedicine has a great opportunity to be developed further in the region of ASEAN through enhancement of cooperation and development programs of ASEAN itself.

1. Introduction

The term telemedicine comes from a simple description of the word 'tele' which means distance or far from Greek, so telemedicine is to provide the health care remotely.[1] While the WHO itself has made a definition of telemedicine, namely *"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[2], Telemedicine technology can help disease sufferers and health institutions to share information easily and quickly. At present the world of computer-based Information and Communication Technology (ICT) has developed and is an integral part of the world of health.[3]

A great promise of telemedicine has been to help isolated or scattered populations gain access to health services.[4] Telemedicine has proven to be a good tool to enable access to knowledge and enable information exchange in industrialized countries, and shows that it is possible to build the quality of health in isolated populations.[5] Telemedicine can also (and must) be able to convey health access to poor areas in the country where there is a scarcity of infrastructure and other developing countries.[6,7] Telemedicine has the potential to make a difference in the lives of many people. For example, telemedicine can improve the process of delivering health services in America by bringing a broader range of services such as radiology, mental health services, and dermatology to communities and individuals who are underserved urban and rural areas. In remote rural areas, where the distance between patients and healthcare professionals can be hundreds of miles, telemedicine can be very meaningful for access to health care where previously only few health access was available. In particular, in cases where rapid medical response times and special care are needed, the availability of telemedicine can be important. In addition, telemedicine can also help attract and retain health professionals in rural areas by providing ongoing training and collaboration with other health professionals.[8]

In India, telemedicine is used to connect all hospitals including small hospitals in the village.[9] Telemedicine establishes remote handling units in large hospitals that have experts who are handled by the doctor. With the teleconferencing system, doctors or nurses in remote villages can conduct long-distance consultations with expert doctors in all major hospitals in India. If more detailed treatment is needed, then the patient is referred to a large and complete hospital. This system also increases the knowledge of doctors and nurses in remote villages with the transfer of knowledge formed. As an archipelago, equity and affordability of health services are still an obstacle. This health facility is not yet fully accessible to the community, especially people in remote, underdeveloped and outermost areas. Meanwhile telemedicine in Indonesia is still in the testing phase of the diagnostic phase, namely teleradiology, telecardiology, and video conference.[10]

The Association of Southeast Asian Nations (ASEAN), which consists of 10 countries: Brunei, Cambodia, Indonesia, Laos, Malaysia, Myanmar, the Philippines, Singapore, Thailand and Vietnam; has been the most significant multilateral country group in Asia for the past 45 years. Since its establishment in 1967, ASEAN has achieved several important achievements in the economic and nonproliferation fields.[11,12] ASEAN is characterized by a lot of diversity in terms of demography, geography, society, economic development, political systems and health outcomes. These factors not only contribute to the health status of a diverse population but also affect various types of health systems, which at various stages of evolution.[13] The benefits of regional cooperation are well understood by ASEAN countries themselves. Communities in Indonesia can use health services from the Philippines using technology of smartphones. This cloud service is very promising for services that are very much needed for ASEAN, especially in remote areas, with prices that are far more affordable. For the economics to work, however, the services must be provided at scale across the region and not at just a national level. This is means not only allowing sensitive data (for example, health data) to flow across borders but also having regional standards governing health services.[14]

Telemedicine has a great opportunity to be further developed in the ASEAN region, given that telemedicine itself will help reach patients in rural areas to continue to get appropriate services, besides that it can also help disease sufferers and health institutions to share information easily and fast. Currently the use of telemedicine is certainly very helpful and has its own trends. A closely associated term with telemedicine is telehealth, which encompasses a broader definition of remote healthcare that includes nonclinical services, such as patient education, disease self-management, and medical training for providers.[15] Examples of the Telehealth application are ODL (Observation of Daily Living) applications, store and forward applications, real-time applications, and patient monitoring remote applications.[16] But while information and communication technologies have tremendous potential for improving healthcare, we have to bear in mind that in rural areas of many developing countries, telephone networks and computers are scarce. This is especially true in the health sector.[17] Another barrier to the implementation of telemedicine in rural areas of developing countries is limited access to electricity.[18] Yet another important factor is the deficient transportation infrastructure resulting in a lack of appropriate maintenance and control systems, limited ability to afford expensive telecommunication infrastructure, and poorly trained health personnel. Information and communication technology and services can improve the health conditions of isolated health staff only if the technology is selected, developed, adapted and well used to meet the real needs of the population in their daily environment.[19]

For the legal aspect, in Indonesia it still does not have laws that regulate the use of telemedicine, but what is currently available is only the regulation of laws related to telematics in general.

Security issues also become a consideration, because the possibility of theft of patient data that can be done through internet media is very large.[16] Because it has almost the same characteristics, that is the reason why ASEAN is an union in the Asian country that is quite good in working together. Cross-border trade also shifted with other equally important ways, especially with the increase in trade in services relative to goods. Citizens in Cambodia can access their health services from the center of medical excellence, in the Philippines using smartphones (combined with technologies such as diagnostic pills that send medical information via bluetooth to a user's smartphone). This cloud service promises great opportunities to deliver much-needed services to ASEAN citizens, especially in remote areas, at prices far more affordable. This paper aims to describe the challenges and opportunities of telemedicine to implemented in ASEAN countries.

2. Methodology

The method used in this paper is literature study. The literature used is a related journal that has been published by local and international journal institution. Data reported in this paper were obtained from published literature, reports, and journals. We used both online search methods to gather the information and literatures. The sources of online data include international and national journal articles and studies from multiple electronic bibliographic databases, including Research Gate, PubMed, and web-based statistics such as World Health Statistics (http://www.who.int/); the Asian Development Bank Institute (http://www.adbi.org/); ASEAN (http://www.asean.org/), National Center for Biotechnology and Information (https://www.ncbi.nlm.nih.gov/) and Kementerian Kesehatan Republik Indonesia (http://hukor.kemkes.go.id /). The following main key search terms were used: Fourth Industrial Revolution in ASEAN, health, healthcare in rural area, ASEAN countries health condition, health-care system in ASEAN, telemedicine, telehealth. In addition, search engines such as Google and Google Scholar were also used. The steps taken are collecting related journals, reviewing journals, discussions, and conclusion.

3. Discussion

3.1. *Health problems in ASEAN countries*

Southeast Asia consists of ten independent countries consisting of Brunei Darussalam, Singapore, Malaysia, Thailand, the Philippines, Indonesia, Vietnam, Laos, Cambodia and Myanmar (Burma), or known as the Association of Southeast Asian Nations (ASEAN) that was established on 8th August 1967 in Bangkok, Thailand. ASEAN in a whole countries contains more than half a billion people in very diverse countries, ranging from economically powerful countries such as Singapore to poorer economies such as Laos, Cambodia and Myanmar. If compared with India and China, Southeast Asia is more less visible in the global politics and economy, as well as global health.[20]

ASEAN countries need to step out from passive growth and take proactive steps to attract investment, develop their institutions, the society and also the technological capabilities. The private sector also has a major role in strengthening the region's growth prospects over the next few years, but not only requires companies to provide new products and services, or to meet various consumer preferences, but also to work more closely with the government to develop the right conditions for business prospered. Looking ahead, there are significant growth opportunities for the private sector in a number of industries in the ASEAN region including the development of medical devices. Increasing income figures, an aging population and the increasing incidence of chronic diseases create a significant demand for health care in ASEAN and the development of the medical equipment industry is very important to ensure this demand is met. Both government and private players have an active role in improving health services in the region through local innovations, digital solutions, skills development, alternative care models and greater regional cooperation.[21]

In case of the spread of epidemiological diseases, ASEAN is a hotspot for emerging infectious diseases, including the diseases that have a potential to become pandemics. Emerging infectious diseases have demanded heavy public health and economy. Acute respiratory syndrome (SARS) quickly destroys the tourism industry in the region. Influenza A (H5N1) has a profound effect on the poultry industry. The reason why Southeast Asia is at risk for developing infectious diseases is quite complex, because this region is a home for a dynamic system in which biological, social, ecological and technological processes are interrelated in ways that allow microbes to exploit new ecological niches.[22] At the same time, ASEAN countries face an epidemiological transition with increased morbidity and mortality from non-communicable diseases or NCDs. NCD is currently responsible for 60% of deaths in the ASEAN region. This disease comes from the ageing of the population, lifestyle behavior (tobacco and alcohol use, unhealthy diet, also lack of physical activity) then the environmental factors.[23]

The ratio of doctors to population ranges from two doctors per 10,000 residents in Cambodia, Indonesia, and Laos, 14 doctors per 10,000 residents in Brunei and 19 doctors per 10,000 in Singapore. In all ASEAN countries, there are more nurses and midwives than doctors in the population, except in Vietnam where there are 12 doctors and only 10 nurses / midwives per 10,000 residents. In general, there are only less than four pharmacists per 10,000 residents in ASEAN countries, except in Singapore and the Philippines. Recent research shows that all countries in Southeast Asia face the same problem, namely the distribution of health workers, where rural and remote areas often lack health workers. Apparently, there is a weak coordination between the production of health workers and the capacity to work in most countries.[24]

3.2. *Telemedicine as the fourth industrial revolution*

The fusion of technologies that are blurring the lines between the physical, digital, and biological spheres is the characteristic of The Fourth Industrial Revolution nowadays.[25] Built on the Third Industrial Revolution, this newest revolution supported by various new breakthroughs not only in the digital realm (such as artificial intelligence) but also in the physical realm (new material), as well as the biological realm (bio-engineering). Artificial intelligence and machine learning, 3D printing, advanced robotics and new forms of automation, ubiquitous mobile internet, cloud computing, sensors and the internet of things (IoT), genetics, and social media are the examples of fourth industrial revolution technology. [14,26] Moreover, telemedicine is currently being developed by some countries all over the world, including Indonesia. This telemedicine, which is a technology to remotely monitor and treat patients through sensors connected to the internet.[27]

The American Telemedicine Association defined the telemedicine as *the use of electronic communications and information technologies to provide clinical services when participants are at different locations*.[28] A closely associated term is telehealth, which encompasses a broader definition of remote healthcare that includes nonclinical services, such as patient education, disease self-management, and medical training for providers.[15] Video-conferencing, image transmission, e-health services, remote monitoring of vital signs, continuing medical education and nursing care centers, these all considered as the part of telemedicine and telehealth service.[28] Whereas the term telemedicine is restricted to direct health care, telehealth has a broader definition.[29]

Telemedicine can be as simple as two health professionals who discuss disease cases by telephone, or it can be complex because it uses satellite technology and video conferencing equipment to conduct direct consultation between medical specialists in different places.[30] Telemedicine can occur in 3 basic types, the first is synchronous or "real time," where the patient at the spoke and the provider at the hub interact simultaneously.[31] Videoconferencing is the most common real-time telemedicine interaction. Synchronous telemedicine requires the presence of both parties at the same time, for this reason it is necessary to connect media between the two parties who can offer real time interaction so that one party can handle health.[4] The second, telemedicine also occurs in the format of asynchronous or "store-and-forward." A store-and-forward interaction involves the transfer of data, such as an X-Ray or a digital image, from the spoke to the hub for review and consultation at a later time.[32] The third type is hybrid or virtual which is combination of both store-and-forward and real time (static and dynamic); having the

advantages of both types. The communication can be health professional-to health professional or health professional-to-patient.[33]

Telemedicine and telehealth utilize ICT to provide a wide array of health services to individuals without requiring the individual to interact face-to-face with the health care provider delivering the care.[34] Telemedicine is one of the real forms of technological progress in the fourth industrial revolution that can eliminate the distance barrier by making doctors more close to their patients without having to meet face to face as before. Telemedicine is also an effort to achieve information management competencies for a doctor, specifically the competence to utilize communication information technology and health information to improve the quality of health services. A clinician can also use telemedicine to ask for second-opinion from a colleague of expert doctors.[35]

3.3. *The opportunities of implementating telemedicine in ASEAN's rural areas*

Some of the ASEAN countries, especially Indonesia, the Philippines and Malaysia, are archipelagic countries and physical linkages have long been a concern in economic development. Similarly, several ASEAN countries have large rural populations in remote areas that have not benefited from the technology of the first and second industrial revolutions.[14] As for the low-income ASEAN countries, Vietnam also exports some health services, mainly to neighboring Cambodia. Nonetheless, most Cambodian patients seeking treatment abroad choose hospitals in Thailand and Singapore.[36] This situation make telemedicine can offers new possibilities for developing distributed structures for services that can overcome geographical limitations and as a good enough alternative to overcome the problem of health inequality in the ASEAN region itself.

The use of technology to provide the health care remotely, or telemedicine, has been proven to be an effective way to overcome certain barriers to care, especially for communities located in rural and remote areas. In addition, telemedicine can reduce disparities in providing essential care for underserved people, mainly due to a shortage of sub-specialty providers.[37] Telemedicine is also intended to reduce referrals to doctors or health services in big cities, medical education facilities and also to cases - emergency case. The expansion of the benefits of telemedicine can reach disaster areas, long-distance flights, and for foreign tourists who are in tourist areas.[38]

With regard to psychiatric diseases, telemedicine is cost-effective as an alternative to expensive travel to seek specialized medical consults.[39] Thus, telemedicine facilitates equitable access to medical care services regardless of the geographical location; reduces waiting times (both for diagnosis and treatment), preventing more serious complications; enables remote consultation from primary care to the referral hospital, thus reducing the number of referrals; and it influences education and competence both at primary health care and hospital levels.[40]

The characteristics of telehealth services in the future using IoT technology is to provide access to electronic medical record data to add information and provide diagnosis and support decision making, use all relevant patient data from health information systems and support collaboration from various health device sources.41 There is potential for greater public-private participation with economic growth through ASEAN integration and further regional health collaboration, despite the current division of the region under two WHO regional offices.[42]

3.4. The challenges of implementating telemedicine in asean's rural areas

The challenges for telemedicine implementation can divided into some classification, there are technological, economic, organizational, and human challenges.[43] In technological challenge, information and communication technologies have tremendous potential for improving healthcare, in rural areas of many developing countries, technological infrastructure such as telephone networks and computers are scarce and limited access to electricity. This is especially true in the health sector[17,18] and also lack of skill to use the technologies. Data security, confidentiality, and protection are also the consideration, because the possibility of theft of patient's data that can be done through internet media is potentially big.[16]

For the economic challenges, the most major barrier to the deployment of telemedicine solutions globally is the perception that costs of telemedicine are too high.[33] Yet another important factor is the deficient transportation infrastructure resulting in a lack of appropriate maintenance and control systems, limited ability to afford expensive telecommunication infrastructure.[44]

Poorly trained health personnel, while the systems being used are complex, and there is the potential for malfunction, which could trigger software or hardware failure.[33,44] Some patients and health care workers resist to adopting the service models that differ from traditional approaches or indigenous practices while others lack ICT literacy to use telemedicine approaches effectively, are the part of human challenges. The last one, for the organizational challenges can be the (re)design of the medical care model and the consequent need for learning about the new health care model;[43] the organizational culture unusual with the sharing and exchange of knowledge and skills with professionals and patients located in remote locations via telecommunication.[33]

4. Conclusion

Telemedicine offers great opportunity as an alternative method of health service delivery to rural areas, especially in some ASEAN countries such as Indonesia, Malaysia and Filipina. The purpose of telemedicine is basically to strive to achieve health services evenly across the country's population, improve service quality, especially for remote areas and cost savings compared to

conventional methods. To appreciate the results of telehealth services, it takes time to conceptualize, plan and assess the needs of telehealth interventions on a small or large scale, along with the right emphasis on change management. Consideration of the factors associated with the success and sustainability should be an integral part of developing services. To conduct telemedicine successfully, it is important that all healthcare organizations and government across ASEAN countries to work together, maximizing the opportunities and overcome the challenges. Meanwhile, focus on the development of telemedicine by working to prepare the appropriate personnel, equipment, telecommunications, technical support and training.

Acknowledgments

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