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The Essence of Telemedicine for Bridging the Gap in Health Services

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Abstract

This study aimed to review the essence of telemedicine in this modern era of technology and innovation, especially in developing countries. It also investigated the regulation aspect as the main component for healthcare services. There were five main categories of telemedicine: revenue stream and technology literacy, health facilities, human resources, data authorization and security, and health protocol. Furthermore, when combined with wearable devices, it enhanced healthcare delivery opportunities. There were two major components of global electronic health, namely telehealth and health informatics, based on e-commerce and e-learning systems. The World Health Organization (WHO) has been able to describe the roles of telehealth services in developing countries. However, some related issues were needed to be well managed, such as the patient data security. It was found that the regular training and evaluation of people with poor educational background, low income, and stress were the main reasons most communities attend healthcare services despite mild sickness. Therefore, those need to be enlightened on the roles and importance of telehealth services.

Keywords: medical development, technology disruption, telemedicine

Introduction

Information and technology have played an important role in transforming the way people live especially in the healthcare sector. Furthermore, it has contributed to improving the knowledge of healthcare providers and the behaviors of some communities. Based on National Health Services, people tend to use telemedicine in a long-term span in order to easily get connected with healthcare services. This includes using a smartphone application, wearable devices, remote monitoring, and reading the genome. Furthermore, it is known for reducing costs, energy, time limitation, and distance.[1] Telemedicine has been widely used since the 1990s, when healthcare providers used telephones whenever a patient felt sick, and later on, the development became accelerated in this modern era.[2] It is divided into three activities: teleconsultation involving telemonitoring, teleexpertise, and teleassistance. A further technological enhancement that also needs to be implemented in the health sector includes virtual and augmented reality, artificial intelligence, robotics, and gene writing. However, these developments have resulted in some arguments concerning ethical considerations and people's perceptions.[1]

Telehealth comes from the word "tele" meaning distant and "health" which means the well-being status of an individual. It is commonly referred to as telemedicine and has also been used to define of health services in various communities. Furthermore, according to World Health Organization (WHO), telehealth and telemedicine are classified as two different terms. Telehealth covers almost the whole aspects of health services communication, especially in promotive and preventive medicine. In contrast, telemedicine is one of the main roots enclosing the activity of curative medicine. Based on these findings, it was concluded that this currative medicine is the part of telehealth which provided health services in various communities.[2]

Primary physicians and nurses or midwives are the main people that mostly interact with patients. They either recommend patients to an expert or administer temporary medicine and observe the condition. Furthermore, each activity would be recorded in the patient's medical record which becomes an important criterion for the telematics and informatics approach.[3]

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Method

This study aimed to review telemedicine in this modern era of technology and innovation, especially in developing countries. It also investigated the regulation aspect as the main component for healthcare services. Furthermore, some sub-topics were evaluated, namely telemedicine regulation and evaluation, health data portal, and medical technology-related issues.

Results and Discussion

Telemedicine regulation and evaluation

Global electronic health has two crucial components; telehealth, based on the e-commerce system, and health informatics, which is based on the e-learning system. These components are both synergized to make up the global system of e-health. Some aspects needed to be improved in health informatics, including decision support systems and surveillance systems, electronic health records, and health portals as the comprehensive evaluation of system health management. Furthermore, the maturity of telehealth needs to be encouraged in each medical specialties, especially for emerging diseases.[5]

There are five main categories used in managing telemedicine: revenue stream and technology literacy, health facilities, human resources, data authorization and security, and health protocol. This was stated on the Circular Letter from the Ministry of Health of the Republic of Indonesia No. 303 of 2020 and the Regulation of Indonesian Medical Council No. 74 of 2020.[6,7] Furthermore, these regulations were used during the pandemic where non-emergency cases and health services were available. This country also needs improvement in regulations associated with virtual healthcare services when transferring patients and emergency cases.

National Health Services made the regulation of telemedicine based on the capitation system. It stated that healthcare providers need to be certified by Membership of the Royal College of General Practitioners (MRCGP) and National Health Services (NHS).[8] Furthermore, other countries' systems, such as the American College of Obstetrics and Gynecology was used as a model in this study. This involved reviewing their insurance regulations concerning telemedicine in overcoming the impact of Coronavirus disease 2019 (COVID-19), such as coding diagnosis remote-patient monitoring, treatment and consultation, and patient-cost sharing.[4,9] In addition, several international health organizations, such as WHO have described telehealth services in developing countries using teleconsultation and telemonitoring between healthcare facilities.[10,11]

Health data portal

Precision medicine foundation is divided into three main categories: the big-data of the medical field; clinical, genomics, and research. Genomics is one of the major pillars in promoting health management and can also be used as a guide in accelerating the development of healthcare delivery. Furthermore, sequencing genomics has resulted in genome mapping which has a great potential benefit associated with health and nutrition. Large biodiversity and microorganism were also used for genome mapping to know the importance of metabolic, physiological, and degenerative processes of a human being. Furthermore, knowledge sharing of genomics is also valuable in supporting biobank and in the development of drug materials.[12]

The second important category is research, and it involves the expansion and evolution of health knowledge. Furthermore, laboratory facilities, collaboration, funding, and the biobank integration are areas that need improvement for individuals to carry out a successful study.[12] The last important category is clinics which involves a clinician, clinical procedure, and patient's communication. In addition, clinical and study data used in teleme-

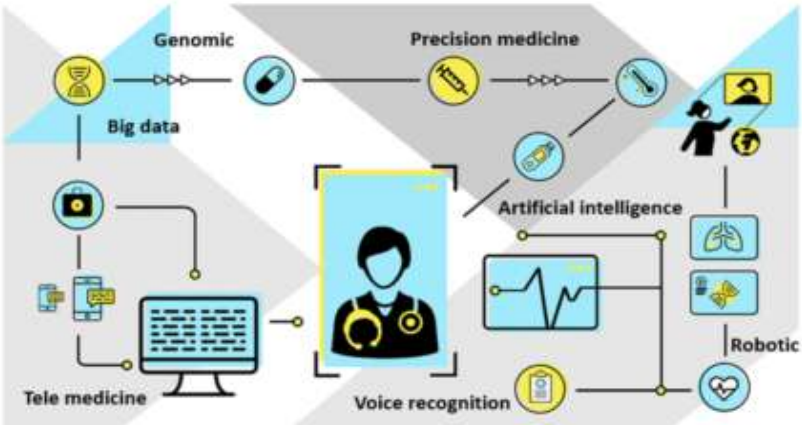

Figure 1. Revolutionize Care Delivery
(Source: https://www.gensler.com/blog/the-pandemics-lasting-effect-on-our-healthcare-system)

dicine and artificial intelligence are normally processed in the cloud data system (Figure 1).

Some components were expected to support the development of telemedicine. However, genomic and big data were the main pillars used in precision medicine. The use of modern technology in the medical sector such as carrying out a simple physical examination using wearable devices, teleradiology, or other static imaging, could be processed and transferred through artificial intelligence. At the same time, robotic technology could also aid in diagnostic or treatment procedures. For easy recording, these data were reported to healthcare providers and recorded into electronic medical records.

Medical technology-related issues

Various medical technology is used in the health evaluation of patients in remote areas (Figure 2). Tele-ultrasonography (USG) is an example of a medical instrument used in monitoring fetal development and needs empowerment from the government to promote a good fetal mortality rate. It is helpful in communities where there are people with cardiovascular disease, advanced age, decreased mobility, and living in a remote area. Since the cardiovascular system is one of the highest contributors to global mortality, it is important to educate patients and companions to increase their knowledge in using telehealth to supervise their health status.[13,14]

Various future medical developments are categorized based on their impact on various communities and the innovation progression. According to Figure 2, telemedicine, regenerative, and precision medicine reached the best progression. According to Smith from Queensland University,[15] many telehealth services were provided to citizens in Australia. This was carried out by establishing telepediatric and teleradiology, used as a distance health system for children and when performing x-rays. The protocol was well-organized via videoconference to monitor a patient's clinical condition. The broadband connection provided a higher capacity of connectivity at a relatively low cost to evaluate the patients in a real-time manner, such as skin, appearance, and chest or abdomen movement. The family expense was stated lower than usual as well as psychological stress and unnecessary visits during an emergency service.[15]

More advanced innovation came from the Electronics Division of Bhabha Atomic Research Centre Mumbai, when Lakhe and his team found a digital stethoscope that could differentiate between heart sound and others. This technology could detect heart sounds using an electron condenser microphone placed on the chest, before being processed and amplified. Furthermore, the background noise was reduced using the adaptive line enhancement technique. The heart sound could be stored, replayed, and sent to medical experts for analysis and evaluation.[16] A low-cost kit for diagnosing lung diseases was also developed by Chamberlain, *et al.*,[17] from the Massachusetts Institute of Technology. Furthermore, an electronic stethoscope along with a peak flow meter was created and recorded using an android smartphone. Before these instruments were invented, heart sounds were heard only by direct physical examination.[17]

The National University of Singapore was the first institution to use telemedicine for rehabilitated patients. This was carried out to reduce the physical barrier and stress experienced by healthcare workers. Their Heart Center also delivered telehealth systems for patients with conditions, such as diabetes, hypertension, and heart failure. The system was monitoring daily blood pressure, blood sugar, and weight transferred to the healthcare provider.[18,19]

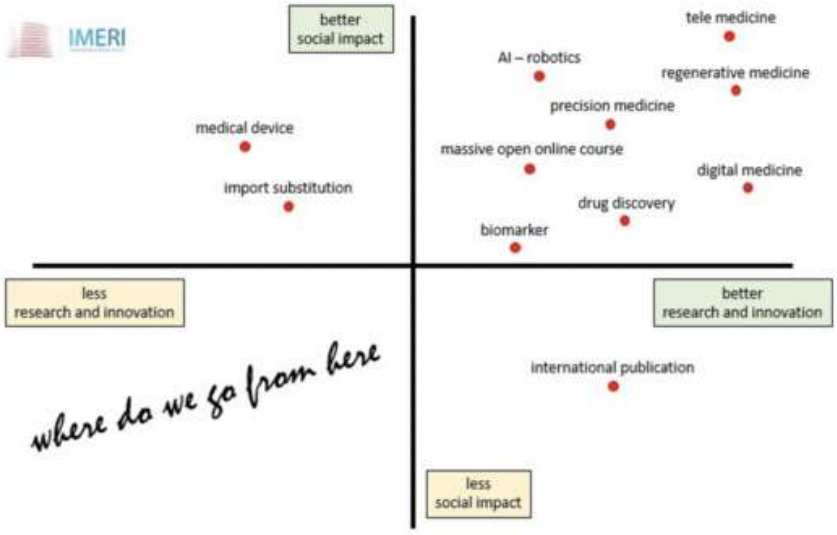

Figure 2. Innovation Traction and Impact Scheme

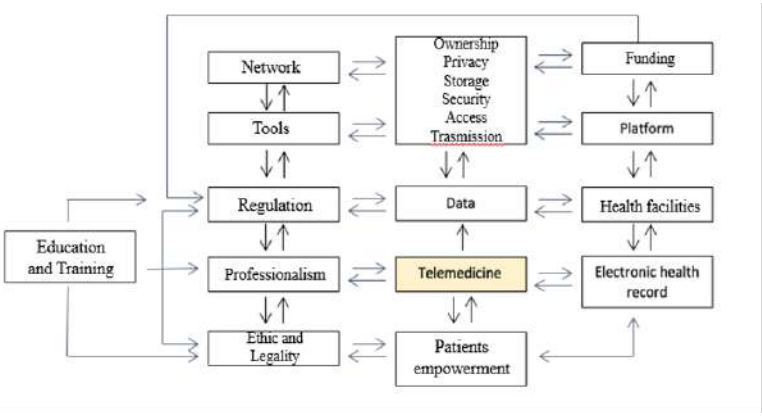

Figure 3. Telemedicine Framework

The telemedicine system requires further development, especially in situations whereby emergency cases and homecare needs urgent attention before being transferred to advanced healthcare facilities. Some examples were shown in the pilot study conducted by Finkelstein, *et al.*,[20], which involved managing more than twenty patients with chronic diseases such as heart failure, chronic obstructive pulmonary disease, and chronic wound successfully. Pre-hospital telecardiology was also reported in reducing the time of segment elevation myocardial infarction (STEMI) diagnosis and management. Moreover, live-remote monitoring and diagnosis of stroke increased the time management of drug administration followed by the quality of treatment and prognosis.[20]

Nevertheless, some issues relating to telehealth need to be managed, such as patient data security of health services. Regular training and evaluation for people with poor educational background, low income, and stress were the main reasons most communities attended healthcare services despite mild sickness. For example, a mother rushed to the hospital because the child had a fever solved through a telehealth platform. The other aspect that also needed improvement was the presence of a physician. Direct communication, gesture, and contact could not be denied as many patients came to doctors just to seek some health tips. Sometimes, some situations led to misunderstandings between the healthcare provider and patients, but this was resolved through effective communication using video call conferences.[10,12,21]

Telemedicine is also an approach to increase the precision of medical care in which patients could be monitored continuously. Patients can reach physicians even if they were limited by the distance, by communicating through telemedicine in a real-time manner or a live-video conversation. A combination of telemedicine and wearable devices improves healthcare. Furthermore, a combination of both telemedicine and wearable devices improved healthcare delivery opportunities by enhancing remote patient monitoring. Imaging and ultrasound recording could also be improved using teleradiology (Figure 1,[22]). Currently, many health platforms were utilized to empowering patients about essential self-care for optimal treatment, such as using mobile health applications, which were normally used as a predictive, preventive, participatory, and personalized tool.[4]

Based on Telemedicine Framework in Figure 3, there were five important areas of telemedicine development, namely (1) patient empowerment, (2) data storage (3) electronic health records (4) professionalism, and (5) capacity development. Capacity development involves providing education and training for a group of people which encompass the settings for data and equipment regulation, professionalism, ethic, and legality.

Conclusion

Telemedicine is an effective way of reducing the limitations of having good healthcare services. Various communities need to be encouraged and empowered with good medical facilities to reduce morbidity and healthcare costs. In addition, long-term evaluation and data securities need to be well-managed to create a good health service system.

Abbreviations

WHO: World Health Organization; MRCGP: Membership of the Royal College of General Practitioners; NHS: National Health Services; COVID-19: Coronavirus Disease 2019; USG: Ultrasonography; STEMI: Segment Elevation Myocardial Infarction.

Ethics Approval and Consent to Participate

Not applicable

Competing Interest

The author declares that there are no significant competing financial, professional, or personal interests that might have affected the per-

formance or presentation of the work described in this manuscript.

Availability of Data and Materials
Not applicable

Authors' Contribution
BW contributed to the conception of the manuscript and joined SCZ in writing the first draft, while SCZ and AL wrote each section. Furthermore, all authors contributed in reviewing the manuscript and also read and approved the submitted version.

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