Literature Review

Indonesian Journal of Health Administration
(Jurnal Administrasi Kesehatan Indonesia)
p-ISSN 2303-3592, e-ISSN 2540-9301
10.20473/jaki.v10i2.2022.261-272

A LITERATURE REVIEW OF TELEMEDICINE IN INDONESIA: PAST, PRESENT, AND FUTURE PROSPECTIVE

Tinjauan Literatur Terkait Perkembangan Telemedicine di Indonesia: Dahulu, Sekarang, dan Masa Depan

***Jeremiah Hilkiah Wijaya[1], Gilbert Sterling Octavius[1], Lie Rebecca Yen Hwei[1]**
[1]Faculty of Medicine, Universitas Pelita Harapan, Indonesia
Correspondence*:
Address: Jl. M.H. Thamrin Boulevard 1100 Lippo Village Tangerang, Indonesia | e-mail: jeremiah.hansum6@gmail.com

Abstract

Background: Indonesia has a great potential in the development of digital health technologies. However, several challenges might also arise in hand with the development of telemedicine.
Aims: We aimed to conduct a literature review of the use of telemedicine in Indonesia in order to know how the start is, the development, and future considerations of its usage.
Methods: From the digital databases of PubMed, Google Scholar, and Neliti (Indonesia's Research Repository), each author completed literature searches of telemedicine in Indonesia from 1985 to 2021.
Results: A total of 8 studies were included in current literature review. In 1985-1987, Indonesia undertook the first satellite-based telemedicine. During the early twenty-first century, rapid improvements in information technology have expanded to other industries, including health care through telemedicine. Covid-19 dilemma compels physicians to adopt. Through telemedicine, many is experienced the benefit during the pandemic. However, in developing telemedicine system for the future, the use of telemedicine has several challenges, namely related to human resources, infrastructure and ethical regulations.
Conclusion: When telehealth is successfully implemented in Indonesia, it will benefit both the developer and the consumer. Despite the benefits, the challenge of implementing and developing a comprehensive eHealth environment in Indonesia might be seen as tremendous, given that the country is currently developing its infrastructure.

Keywords: Covid-19, Indonesia, satellite, telemedicine

Abstrak

Latar Belakang: *Karena sedikitnya literatur yang ada, sangat sedikit yang diketahui mengenai perkembangan telemedika di Indonesia.*
Tujuan: *Kami bertujuan untuk melakukan tinjauan literatur mengenai perkembangan telemedika di Indonesia untuk mengetahui bagaimana permulaan, perkembangan, dan pertimbangan penggunaannya di masa depan..*
Metode: *Dari beberapa database digital, seperti PubMed, Google Scholar, dan Neliti, masing-masing peneliti menyelesaikan penelusuran literatur telemedicine di Indonesia dari tahun 1985 hingga 2021.*
Hasil: *Sebanyak 8 studi dimasukkan dalam tinjauan literatur saat ini. Pada 1985-1987, Indonesia mengimplementasikan telemedika berbasis satelit untuk yang pertama kalinya. Selama awal abad 21, kemajuan pesat dalam teknologi informasi meluas ke industri lain, termasuk kesehatan melalui telemedika. Dilema Covid-19 memerlukan dokter untuk mengadopsi. Melalui telemedika, banyak manfaat yang dirasakan. Namun dalam mengembangkan sistem telemedika ke depannya akan ditemukan beberapa tantangan yaitu terkait dengan sumber daya manusia, infrastruktur, dan masalah etika.*
Kesimpulan: *Ketika telemedika berhasil diterapkan di Indonesia, maka akan sangat menguntungkan dalam banyak aspek. Selain itu, tantangan untuk mengimplementasikan dan mengembangkan telemedika di Indonesia mungkin akan sangat sulit karena Indonesia sedang mengembangkan infrastruktur teknologinya.*

Kata kunci*: Covid-19, Indonesia, satelit, telemedika*

Indonesian Journal of Health Administration (*Jurnal Administrasi Kesehatan Indonesia*)
p-ISSN 2303-3592, e-ISSN 2540-9301, Volume 10 No.2 2022, DOI: 10.20473/jaki.v10i2.2022.261-272
Received: 2021-11-10, Revised: 2022-10-18, Accepted: 2022-11-03, Published: 2022-12-10.
Published by Universitas Airlangga in collaboration with *Perhimpunan Sarjana dan Profesional Kesehatan Masyarakat Indonesia (Persakmi)*.
Copyright (c) 2022 Jeremiah Hilkiah Wijaya, Gilbert Sterling Octavius, Lie Rebecca Yen Hwei
This is an Open Access (OA) article under the CC BY-SA 4.0 International License (https://creativecommons.org/licenses/by-sa/4.0/).
How to cite:
Wijaya, J. H., Octavius, G. S. and Hwei, L. R. Y. (2022) "A Literature Review of Telemedicine in Indonesia: Past, Present, and Future Prospective", *Indonesian Journal of Health Administration*, 10(2). pp. 261–272. doi: 10.20473/jaki.v10i2.2022.261-272.

Indonesian Journal of Health Administration
(Jurnal Administrasi Kesehatan Indonesia)
p-ISSN 2303-3592, e-ISSN 2540-9301
10.20473/jaki.v10i2.2022.261-272

Introduction

Indonesia as the world's fourth-largest population has a great potential in the development of digital health technologies. The technology may assist Indonesia citizens in accessing healthcare way easier than ever before (Tuckson, Edmunds and Hodgkins, 2017) This will benefit the country's more than 260 million individuals across the country (*Population, total - Indonesia | Data*, 2018) The development and innovation of eHealth, which enables users to share and search for the most recent information, long-distance consultations with doctors, including e-prescribing, and exchange of patient health records, is what's driving the digital revolution in the health industry. (Tuckson, Edmunds and Hodgkins, 2017).

Telemedicine has the potential to shift care from a practice-cantered model to a patient-cantered model, reducing travel time or requesting for a school or work leave. However, there is no universally accepted definition of telemedicine at this time. Telemedicine, telehealth, and eHealth are all concepts that are frequently used interchangeably (Hilty *et al.*, 2013). These are the terminology used to describe how information technology systems are utilized in the healthcare industry to improve communication between patients and healthcare professionals, especially those who live in remote locations. Telemedicine, according to the World Health Organization (WHO), is the use of information and communication technology to provide health care, particularly in areas where access to medical services is limited. (WHO Telemedicine, 2010) Telemedicine is traditionally defined as the delivery of medical treatment through the internet using audio-visual technology. (Grossman *et al.*, 2020) Telehealth is the use of medical devices, activity trackers, automated reminders, blood glucose monitors, and other tools to collect and send health information, frequently with the aim of monitoring or managing chronic illnesses. It also includes telemedicine technologies. Telehealth can also aid in the development and improvement of health-related education, health management, and general public health (Edirippulige and Armfield, 2017).

The term 'eHealth' is also used in several European countries to designate digital health and technology-driven remote health care. Before 1999, this term was little in use; it now appears to serve as a general buzzword, describing not only internet medicine, but also nearly everything related to computers and medicine. They coined this term, along with others like e-commerce, e-business, e-solutions. The word eHealth is often used to refer to a broader range of digital information tools, such as electronic health records, which makes it easier for health care practitioners to share patient data. Computerized physician order entry systems, e-prescribing, and clinical decision support technologies are examples of eHealth, which offer physicians with electronic information on protocols and standards for diagnosing and treating patients. (Edirippulige and Armfield, 2017).

However, due of the limitation of small number of published literatures, little is known about the development and the effectiveness of telemedicine use in Indonesia. Doctors are also less familiar with telemedicine since they are unaware of the implications of its use in any medical practice. During the COVID-19 pandemic, clinicians will attempt to use this technology for outpatient care in order to facilitate access and convenience of care. Several challenges might also arise in hand with the development of telemedicine in Indonesia, such as human resources, infrastructure and ethical regulations (Kawaji *et al.*, 1990). Thereby, we aimed to conduct a literature

Indonesian Journal of Health Administration
(Jurnal Administrasi Kesehatan Indonesia)
p-ISSN 2303-3592, e-ISSN 2540-9301
10.20473/jaki.v10i2.2022.261-272

review of the use of telemedicine in Indonesia in order to know how the start is, the development, and future considerations of its usage.

Method

From the digital databases of PubMed, Google Scholar, and Neliti (Indonesia's Research Repository), each author (G.S, L.R, and J.H) completed literature searches of telemedicine in Indonesia from 1985 to 2021 on 17 September 2021. As far as the available documentation, telemedicine practice was initially trialled back in 1985. As such, we included studies in 1985 afterward. We used the terms "telemedicine", "telemedika", "telenursing", "remote consultation", "telehealthcare", "telemonitoring", "remote monitoring", "tele-education", "health messages", "remote diagnosis", "telediagnosis", "teleconsult", "mobile health", "mHealth", "eHealth", and "Indonesia". We conducted literature searches from 1 January 1985 until 17 September 2021. From 1347 published scientific articles, 337 studies were deleted due to duplicates. Following title and abstract screening, we selected 35 articles for full text screening. The authors excluded 18 studies for not reporting the key interests, 3 meeting abstracts, 4 studies conducted not in Indonesia, and 2 studies duplicate. We deemed 8 studies to be eligible for current literature review. We collected all reports on telemedicine use in Indonesia with restrictions to English and Indonesian language. Telemedicine refers to the use of electronic communications channels or mediums and information technology to deliver clinical services. As the primary endpoint of our study, articles were required to give original data on telemedicine use in Indonesia. We exclude narrative, conference abstracts, commentary, perspective, and opinion. Nonprimary literature was excluded due to lacking credibility. However, we still retrieved studies from a systematic review, abstracts, and other nonprimary literature references to ensure literature saturation. The approach we used for current review is traditional review.

Initially, each author (G.S, L.R, and J.H) screened the title or abstracts for extracted articles from each electronic source. After that, we read the remaining pieces in full paper format and decided which papers were eligible for our study. Any discrepancies were resolved through discussion by the authors. We critically appraised the quality of included studies using the Joanna Briggs Institute (JBI) for case report or Newcastle-Ottawa Scale (NOS) as appropriate.

For data extraction, we collected the demographic characteristics (total patients, age, and sex), publication year, medical fields (e.g., neurology, cardiology, or other), study design, and results from each study.(Suksmono *et al.*, 2014) We aimed to conduct a literature review of the use of telemedicine in Indonesia in order to know how the start is, the development, and future considerations of its usage.

Result and Discussion

Historical start of telemedicine in Indonesia

In 1985-1987, Indonesia undertook the first satellite-based telemedicine trial and other academic activities as part of the SHARE (Satellite for Health and Rural Education) project supported by Intelsat to honour its their anniversary. (Abdulrachman and Abdulrachman, 1991) Practice of teleconference was reported to be first used in Indonesia in the 1985, between an Indonesian National University and the World Health Organization (WHO). The data that was transferred was in text format (Suksmono *et al.*, 2014).

Indonesian Journal of Health Administration
(Jurnal Administrasi Kesehatan Indonesia)
p-ISSN 2303-3592, e-ISSN 2540-9301
10.20473/jaki.v10i2.2022.261-272

Indonesia completed a low-cost "Still Picture Transmission by Narrowband Technique" for educational and medical services in the early 1990s, followed by a series of image processing studies on a laboratory scale. Pan Asia-Pacific Region Telecommunication Network for Tests and Research by Satellite (PARTNERS), a cooperation financed by Japan's Myanmar Posts and Telecommunications and managed by the Association of Radio Industries and Businesses, was established to undertake experiments on Engineering Test Satellite-Five L-Band transmission and related applications (Suksmono *et al.*, 2014). Slow scan video lectures were held among our PARTNERS members (1992-1997) (Nakajima *et al.*, 2001). Educational and medical messaging can utilize this type of application conducted by Tokai University's School of Medicine, which is one of the partners for ITB (*Institut Teknologi Bandung*) school of engineering. In 1997, a satellite-based telemedicine experiment was conducted between the UNJANI (*Universitas Achmad Yani*) Faculty of Medicine and Engineering in Bandung as the centre/control station, the Central Hospital of Mataram, and the *Harapan Kita* Hospital in Jakarta (Nakajima *et al.*, 2001). The trial was on maternal care using a television in order to conduct the trial in Indonesia's eastern territory. Another post-PARTNERS telemedicine experiment was a wireless-based telemedicine system that connected one university hospital and one university in Bandung, Hasan Sadikin Hospital and UNJANI via JCSAT 3 satellite-linked between ITB and Ohkura National Hospital in Japan (Tedeschi, 2020). Another telemedicine activity was carried out in the ITB's Biomedical Laboratory. The research team created an internet-based telemedicine system for the country's Primary Community Health Centre (*Puskesmas*). Tele-consultation, basic tele-diagnostic, tele-coordination, tele-education, and medical databases are among the services provided (Suksmono *et al.*, 2014).

During the early twenty-first century, rapid improvements in information technology have expanded to other industries, including health care through telemedicine. Despite the governmental decree on initiating telemedicine practice (tele-ECG) in 2011, (*Menteri Kesehatan Republik Indonesia*, 2020) there have been several medical researches of telemedicine in 2004. Telemedicine via an internet connection was developed for the Community Health Centres (*Puskesmas*) which supported teleconsultation, telediagnosis, simple tele coordination, tele-education, and drug databases, among other applications (Suksmono *et al.*, 2014). In the same year, a telebiomicroscopy was developed by the Research Group of Padjajaran University's Faculty of Health (Suksmono *et al.*, 2014). A wireless communication channel in this system was used to transmit a microscopic description of an eye condition. As a result of the findings, it was determined that an eye illness diagnosis might be performed remotely utilizing a telemedicine system. Another experiment was carried out in a compromised hemodynamic state, with vital patient data provided over a communication link. The outcome of the experiment was also encouraging (Suksmono *et al.*, 2014).

A web-based medical information system for broad communities has been created by PT Telkom (Indonesia's national telecommunications corporation). Teleconsultation and tele-education were implemented as part of another trial called MediFa, which uses a videophone to connect primary care clinics and referral hospitals. This technology was expanded over the next few years to include video streaming, Short Message Service, and Wireless Application Protocol for usage by

Indonesian Journal of Health Administration
(Jurnal Administrasi Kesehatan Indonesia)
p-ISSN 2303-3592, e-ISSN 2540-9301
10.20473/jaki.v10i2.2022.261-272

family doctors. (Nugraha and Aknuranda, 2017) Telemedicine continued developing until 2005, and until then, Indonesian engineering established an ICT-based e-health system designed for epidemic management. For a web-based epidemic management system and a mobile phone-based system with multiple communication links, many e-health prototypes have been developed. A mobile communications system was created by teams from the hospital, various health service units, and the ambulance in order to determine what equipment was easily available (Soegijoko *et al.*, 2011). Mobile telemedicine was created up until 2007 as a component of a tele-emergency effort to provide medical care in remote areas. A mobile telemedicine system prototype that consists of both hardware and software could be swiftly set up in rural locations or at disaster sites where the communications infrastructure has collapsed (Shimizu *et al.*, 2010).

Telemedicine applications were first launched in 2010 as part of a biomedical technique that included a simple block diagram and multiple disciplines. E-health applications were developing to provide real-time connections between medical stations and terminals for teleconsultations between general practitioners and specialists. That store-and-forward can be used to distribute a short report about patient recapitalization at a community health centre. In 2011, short message service technology for streamed audio and video data in a mobile setting was used to develop e-health applications for disease detection (Shimizu *et al.*, 2010). To assist with patient and pharmaceutical data, an e-prescription system with a mobile e-health system for child and mother therapy was built in the same year. The SMS module in this system can transmit short messagesin various operation modes. An SMS software module and a modem connected to a PC-based e-health system constitute an e-prescription for mobile e-health, in essence. (Nugraha and Aknuranda, 2017) Telemedicine vastly developed the focus on mobile-based health systems. As of 2018, the government manages seven network-based health care applications and 18 private online health service applications. Although various platforms provide online health information and services, many Indonesians have yet to use this app. According to a poll performed between May and July 2018, 67.6% of 102 respondents have never used an online health service application (Husni *et al.*, 2006).

Before the pandemic

Health service innovations in the digital era help patients use their time more efficiently, such as reduction in hospital traveling time and health facilities for consultations. There are 7 network-based health service applications managed by the government and 18 private online health service applications which can be seen from Table 1 (Husni *et al.*, 2006). Until now, there have been no permanent regulation in implementing telemedicine, considering that currently only circulars issued by the Minister of Health, such as *Menteri Kesehatan Nomor 20 Tahun 2020 tentang Pentelengaraan Pelayanan Telemedicine Antarfasilitas Pelayanan Kesehatan* and *Surat Edaran Menkes Nomor 303 Tahun 2020 tentang Penyelengaraan Pelayanan Kesehatan dengan Teknologi Indoenamsi selama Pandemi* COVID-19. This is where the role of the Minister of Health and the *Badan Penyelenggara Jaminan Sosian* (BPJS) plays a role. BPJS is conducting a trial of telemedicine financing for participants of the National Health Insurance (JKN) for referrals using a system called Indonesia Case Base Group (INA-CBG).(*Deloitte 2019*, 2019) INA-CBG is a payment system with a package

Indonesian Journal of Health Administration
(Jurnal Administrasi Kesehatan Indonesia)
p-ISSN 2303-3592, e-ISSN 2540-9301
10.20473/jaki.v10i2.2022.261-272

system that has been established for both public and private hospitals. It is based on the patient's disease and the technique of paying for patient treatment based on cases or diagnoses that are generally comparable. In addition, JKN tariff revisions are being discussed to include telemedicine financing. In the current JKN era, 1,227 hospitals have implemented the INA-CBG. (*Deloitte 2019*, 2019).

The number of supporting health centres for telemedicine programs in five years is developed according to the road map of the Indonesian Ministry of Health. The Ministry of Health's 5-year (2015-2019) telemedicine program roadmap is prioritized for poot regions and islands or called as *Daerah Tertinggal Perbatasan dan Kepulauan* (DTPK) where health facilities are very difficult to be accessed by the community. The target of telehealth facilities by the Ministry of Health is prioritized at 120 tertiary healthcare facilities in the DTPK or also known as "*Puskesmas*". The target of the referral hospital programmed in 2015 is around 3 supporting hospitals. The target for 2019 is to reach 42 referral hospitals. The telehealth program in this study was started in 2016, with a target of eight supporting hospitals. If it is assumed that the number of health centres supported by each supporting hospital is 10 health centres. The number of puskesmas trained in the first year (2016) was 80 puskesmas. The number of densely packed health centres in 2020 will reach 680 health centres. The target of this telehealth program is for areas outside the border and underdeveloped. This program will be successful if the area has access to electricity and is affordable by data services at least third generation (3G) technology. (Indonesia Ministry of Health, 2018a).

Table 1. Online health service applications managed by the government and private.

Government	Private
Layanan kesehatan ke rumah 24 jam berbasis telemedicine dan teleradiologi di Makassar (Dottorro'ta)	Alodokter
JKN Mobile	GO-MED
Verifikasi Digital Klaim/Vedika BPJS	Gue Sehat
Acquired Immunde Deficiency Syndrome (AIDS) Digital Application	HaloDoc dan GoApotik
TeleEKG, TeleUSG, TeleKonsultasi, dan TeleRadiologi	Homedika
P-Care BPJS	Homecare24
Application for outpatient registration	Indonesia Kalkulator of Oocyte
	K24 Klik
	Klik Dokter
	Medika App
	Medico
	MIMS Indonesia
	PesanLab
	periksa.id
	Pro Sehat
	RSPI Mobile
	TeleCTG
	Sehati

Indonesian Journal of Health Administration
(Jurnal Administrasi Kesehatan Indonesia)
p-ISSN 2303-3592, e-ISSN 2540-9301
10.20473/jaki.v10i2.2022.261-272

During the pandemic

The Covid-19 epidemic has triggered a global crisis that is putting an unprecedented strain on the healthcare system. Hospitals with a high number of Covid-19 patients that require immediate care influence medical personnel's health and the necessity for personal protective equipment. Surgeries, technology, and expertise can all provide challenges for doctors when performing medical treatments. Because doctors are unfamiliar with the current conditions, the current Covid-19 dilemma compels physicians to adopt technology that they do not understand. Additionally, in order to scale up the healthcare systems and modernize healthcare delivery as healthcare systems across the nation get ready for an inflow of Covid-19 cases, quick action is required. (Ventura, Gibson and Collier, 2020).

Patients with chronic conditions are treated at home according to their physician's instructions and directions during the current Covid-19 pandemic. By utilizing the digital technologies, physicians can monitor the patient's progress without having to visit the patient. Patients with chronic conditions may have comorbidities that increase the chance of Covid-19 infection worsening; thus, healthcare providers must make efforts to limit Covid-19 patients with chronic disease comorbidities from hospitalization (Bendelin *et al.*, 2020). On the other hand, the use of telemedicine in the treatment of chronic diseases makes it easier to control patient medication (Orozco-Beltran *et al.*, 2017). Additionally, telemedicine is beneficial in reducing the number of visits to the hospital and arrivals to the emergency department (Eccleston *et al.*, 2020). Telemedicine can support patient self-management starting from medication prescription, lifestyle modification, and patient emotional management effectively, which then improve the quality of patient outcomes (Hanlon *et al.*, 2017). Through telemedicine, patients with chronic diseases can be avoided from Covid-19 infection that are at risk of increasing the risk of patient death (Guan *et al.*, 2020).

Research evaluating the use of telemedicine in Indonesia is still rarely done. In the current literature review, we included eight studies between 2017 and 2021 (Konduri *et al.*, 2017; Amir *et al.*, 2019, 2021; Aisyah *et al.*, 2020; Garg *et al.*, 2020; Mappangara *et al.*, 2020; Wijaya, Paramitha and Pinzon, 2020; Rinawan *et al.*, 2021). Of the total, three studies evaluating the use of telemedicine in the cardiology field (Amir *et al.*, 2019, 2021; Mappangara *et al.*, 2020) four studies in public health (Konduri *et al.*, 2017; Aisyah *et al.*, 2020; Garg *et al.*, 2020; Rinawan *et al.*, 2021) and one study from the field of neurology (Wijaya, Paramitha and Pinzon, 2020). All research was a prospective cohort study. Eligible studies discovered that telemedicine helps in diagnosing and treating patients effectively and efficiently.

Future prospect of telemedicine in Indonesia

Although telemedicine can improve the quality of medical practice during a pandemic, the use of telemedicine has several challenges, namely related to human resources, infrastructure and ethical regulations (Tedeschi, 2020). Doctors and health policymakers are currently still paying less attention to the use of telemedicine to integrate it into the national health system (Omboni, 2020). Due to the need for doctors to master new and complicated consultation techniques, the use of telemedicine by medical professionals is still restricted during the present Covid-19 epidemic (Smith *et al.*, 2020). In addition, health policy-making factors regarding telemedicine depend on the geographical conditions of the application of the technology, which limit

Indonesian Journal of Health Administration
(Jurnal Administrasi Kesehatan Indonesia)
p-ISSN 2303-3592, e-ISSN 2540-9301
10.20473/jaki.v10i2.2022.261-272

the use of telemedicine in urban areas due to the ease of access to health care facilities compared to remote locations (Smith *et al.*, 2020). The majority of existing telemedicine policies use telemedicine in rural and remote areas to make it easier for rural communities to consult doctors without travelling long distances. In the context of Covid-19, telemedicine is needed in dense populations that have a high risk of transmission, such as in urban areas. Therefore, promotions related to the use of telemedicine can be a priority in pandemic conditions to minimize the risk of transmission through person-to-person contact (Kichloo *et al.*, 2020).

Procurement of telemedicine facilities requires infrastructure that can support telemedicine applications. However, it is undoubted that a significant challenge in developing countries is the basic infrastructure such as electricity, electronic hardware, communication equipment, and software applications to support telemedicine activities (Combi, Pozzani and Pozzi, 2016). Deloitte has suggested a framework called “Five Yearly Developmental Goal” in which infrastructure, data storage, and eHealth actualization (Smart hospital using Integrated Management Information System) are comprehensively planned (Deloitte 2019). In addition, the financial difficulties of using telemedicine in medical procedures are due to the unclear return on investment due to unclear income measures and complex insurance reimbursement (Iribarren *et al.*, 2017). The financial challenges associated with procurement of telemedicine infrastructure hinder in the necessary technologies development and thus limit the application of telemedicine in medical practice (Kim and Zuckerman, 2019).

The accessibility of medical records via telemedicine during doctor-patient consultations is one of the problems in promoting the field of telemedicine (Orozco-Beltran *et al.*, 2017; Bendelin *et al.*, 2020). Privacy of data and medical records is a concern when using telemedicine in every practice of doctors. This condition results from telemedicine's use of unregulated medicine. Problems in ethical aspects related to patient information for treatment can cost a lot of money in solving these problems (Tedeschi, 2020). To address these moral dilemmas, medical professionals must inform patients about the restrictions placed on their use of telemedicine so that they can consent to it or decline. To guarantee patients of the confidentiality of patient data and information, clinicians using telemedicine must also follow specific rules and laws (Ventura, Gibson and Collier, 2020). Figure 1 depicts an overview of development of telemedicine in Indonesia.

Conclusion

When telehealth is successfully implemented in Indonesia, it will benefit both the developer and the consumer in many aspects. Despite the benefits, the challenge of implementing and developing a comprehensive eHealth environment in Indonesia might be seen as tremendous, given that the country is currently developing its infrastructure. This literature review provides the government’s and private companies’ effort in developing and strengthening the telemedicine infrastructure in the country. Also, promising future of telemedicine should be balanced with some ethical and human resources issue.

Indonesian Journal of Health Administration
(Jurnal Administrasi Kesehatan Indonesia)
p-ISSN 2303-3592, e-ISSN 2540-9301
10.20473/jaki.v10i2.2022.261-272

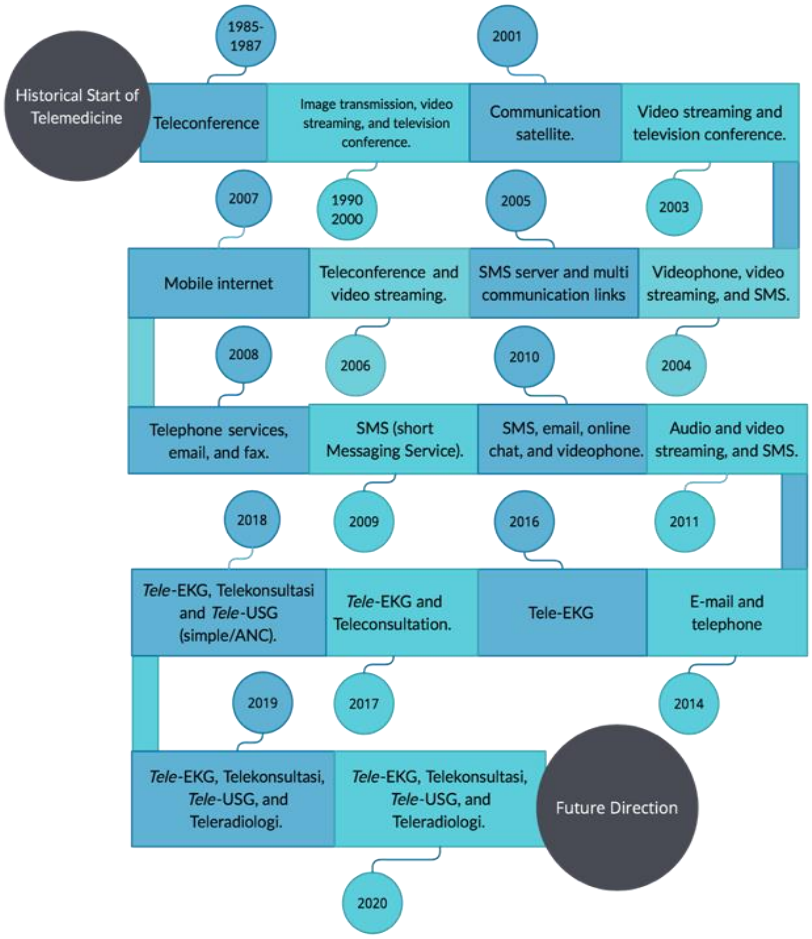

Figure 1. An overview of development of telemedicine in Indonesia.

Abbreviations

Covid-19: Coronavirus Disease 2019; 3G: Third generation; DTPK: *Daerah Tertinggal Perbatasan dan Kepulauan*; *Posyandu*: Pos Pelayanan Terpadu; *Puskesmas*: Pusat Kesehatan Masyarakat; TeleEKG: Tele-Electrocardiogram; TeleUSG; Tele-Ultrasonography; INA-CBG; Indonesia Case Base Group; JKN: Jaminan Kesehatan Nasional; BPJS; *Badan Penyelenggara Jaminan Sosial*; SMS; Short Message System; PC; Personal computer; ICT; Information and Communications Technology; ITB; *Institut Teknologi Bandung*; UNJANI; *Universitas Achmad Yani*; PARTNERS; Pan Asia-Pacific Region Telecommunication Network for Tests and Research by Satellite; NOS; Newcastle-Ottawa Scale; JBI; Joanna Briggs Institute; WHO; World Health Organization

Declarations

Ethics Approval and Consent Participant

Not applicable

Conflict of Interest

The authors declare that there is no significant conflict of interest that might have affected the performance.

Availability of Data and Materials

Data and material research are available upon reasonable requests. For more information, contact the corresponding author (JH).

Authors' Contribution

The study was developed and designed by GH, LR, and JH. All authors contributed in

Indonesian Journal of Health Administration
(Jurnal Administrasi Kesehatan Indonesia)
p-ISSN 2303-3592, e-ISSN 2540-9301
10.20473/jaki.v10i2.2022.261-272

writing this manuscript equally. The data was collected and extracted by GH, LR, and JH. The final manuscript was read and approved by the authors.

Funding Source
Not applicable.

Acknowledgment
Not applicable.

References

Abdulrachman, Sukarno and Abdulrachman, S (1991) 'Impact of The Use of The Palapa Satellite on The Development of Indonesia and The Asia-Pacific Region Seminar on The Socioeconomic Impact of Broadcast Satellites in The Asia-Pacific Region Jakarta, 25-27tm July 1990

Aisyah, D. N. *et al.* (2020) 'Knowledge, Attitudes, and Behaviors on Utilizing Mobile Health Technology for TB in Indonesia: A Qualitative Pilot Study.', *Frontiers in public health*, 8, p. 531514. doi: 10.3389/fpubh.2020.531514.

Amir, M. *et al.* (2019) 'Characteristics and Prevalence of Premature Ventricular Complex: A Telemedicine Study.', *Cardiology research*, 10(5), pp. 285–292. doi: 10.14740/cr887.

Amir, M. *et al.* (2021) 'Telemedicine for detecting Brugada Syndrome in eastern Indonesia: A multi-center prospective observational study.', *Annals of medicine and surgery (2012)*, 65, p. 102334. doi: 10.1016/j.amsu.2021.102334.

Bendelin, N. *et al.* (2020) 'Patients' experiences of internet-based Acceptance and commitment therapy for chronic pain: a qualitative study.', *BMC musculoskeletal disorders*, 21(1). doi: 10.1186/s12891-020-03198-1.

Combi, C., Pozzani, G. and Pozzi, G. (2016) 'Telemedicine for Developing Countries. A Survey and Some Design Issues.', *Applied clinical informatics*, 7(4). doi: 10.4338/ACI-2016-06-R-0089.

Deloitte 2019 (2019). Available at: https://www2.deloitte.com/content/dam/Deloitte/id/Documents/public-sector/id-gps-ehealth-publication-Indonesia.pdf (Accessed: 26 October 2021).

Eccleston, C. *et al.* (2020) 'Managing patients with chronic pain during the COVID-19 outbreak: considerations for the rapid introduction of remotely supported (eHealth) pain management services.', *Pain*, 161(5). doi: 10.1097/j.pain.0000000000001885.

Edirippulige, S. and Armfield, N. (2017) 'Education and training to support the use of clinical telehealth: A review of the literature', *Journal of Telemedicine and Telecare*, 23(2), pp. 273–282. doi: 10.1177/1357633X16632968.

Garg, P. R. *et al.* (2020) 'Mobile Health App for Self-Learning on HIV Prevention Knowledge and Services Among a Young Indonesian Key Population: Cohort Study.', *JMIR mHealth and uHealth*, 8(9), p. e17646. doi: 10.2196/17646.

Grossman, Z. *et al.* (2020) 'The future of telemedicine visits after COVID-19: perceptions of primary care pediatricians', *Israel Journal of Health Policy Research*, 9(1), p. 53. doi: 10.1186/s13584-020-00414-0.

Guan, W.-J. *et al.* (2020) 'Comorbidity and its impact on 1590 patients with COVID-19 in China: a nationwide analysis.', *The European respiratory journal*, 55(5). doi: 10.1183/13993003.00547-2020.

Hanlon, P. *et al.* (2017) 'Telehealth Interventions to Support Self-Management of Long-Term Conditions: A Systematic Metareview of Diabetes, Heart Failure, Asthma, Chronic Obstructive Pulmonary Disease, and Cancer.', *Journal of medical Internet research*, 19(5). doi: 10.2196/jmir.6688.

Hilty, D. M. *et al.* (2013) 'The effectiveness of telemental health: a 2013 review.', *Telemedicine journal and e-health : the official journal of the American Telemedicine Association*, 19(6), pp.

Indonesian Journal of Health Administration
(Jurnal Administrasi Kesehatan Indonesia)
p-ISSN 2303-3592, e-ISSN 2540-9301
10.20473/jaki.v10i2.2022.261-272

444–54. doi: 10.1089/tmj.2013.0075.

Husni, E. M. *et al.* (2006) 'Mobile ad hoc network and mobile IP for future mobile telemedicine system', in *2006 IFIP International Conference on Wireless and Optical Communications Networks*. IEEE. doi: 10.1109/WOCN.2006.1666562.

Indonesia Ministry of Health (2018a) *Menkes Resmikan Program "Nusantara Sehat"- Badan Pengembangan dan Pemberdayaan SDM Kesehatan*, *Menteri Kesehatan Republik Indonesia*. Available at: http://bppsdmk.kemkes.go.id/web/berita/459-329/menkes-resmikan-program-aoenusantara-sehata (Accessed: 26 October 2021).

Iribarren, S. J. *et al.* (2017) 'What is the economic evidence for mHealth? A systematic review of economic evaluations of mHealth solutions.', *PloS one*, 12(2). doi: 10.1371/journal.pone.0170581.

Kawaji, A. *et al.* (1990) 'In vitro toxicity test of poisonous mushroom extracts with isolated rat hepatocytes.', *The Journal of toxicological sciences*, 15(3), pp. 145–56. doi: 10.2131/jts.15.145.

Kichloo, A. *et al.* (2020) 'Telemedicine, the current COVID-19 pandemic and the future: a narrative review and perspectives moving forward in the USA.', *Family medicine and community health*, 8(3). doi: 10.1136/fmch-2020-000530.

Kim, T. and Zuckerman, J. E. (2019) 'Realizing the potential of telemedicine in global health.', *Journal of global health*, 9(2). doi: 10.7189/jogh.09.020307.

Konduri, N. *et al.* (2017) 'User experience analysis of an eHealth system for tuberculosis in resource-constrained settings: A nine-country comparison', *International Journal of Medical Informatics*, 102, pp. 118–129. doi: 10.1016/j.ijmedinf.2017.03.017.

Mappangara, I. *et al.* (2020) 'Tele-ECG consulting and outcomes on primary care patients in a low-to-middle income population: the first experience from Makassar telemedicine program, Indonesia.', *BMC family practice*, 21(1), p. 247. doi: 10.1186/s12875-020-01325-4.

Nakajima, I. *et al.* (2001) 'The final report of the project "AMINE" The Asia Pacific Medical Information Network using with ETS-V', *International Journal of Medical Informatics*, 61(2–3). doi: 10.1016/S1386-5056(01)00130-7.

Nugraha, D. C. A. and Aknuranda, I. (2017) 'An Overview of e-Health in Indonesia: Past and Present Applications', *International Journal of Electrical and Computer Engineering (IJECE)*, 7(5). doi: 10.11591/ijece.v7i5.pp2441-2450.

Omboni, S. (2020) 'Telemedicine During the COVID-19 in Italy: A Missed Opportunity?', *Telemedicine journal and e-health : the official journal of the American Telemedicine Association*, 26(8). doi: 10.1089/tmj.2020.0106.

Orozco-Beltran, D. *et al.* (2017) 'Telemedicine in Primary Care for Patients With Chronic Conditions: The ValCrònic Quasi-Experimental Study.', *Journal of medical Internet research*, 19(12). doi: 10.2196/jmir.7677.

Population, total - Indonesia | Data (2018). Available at: https://data.worldbank.org/indicator/SP.POP.TOTL?locations=ID (Accessed: 26 October 2021).

Rinawan, F. R. *et al.* (2021) 'Understanding mobile application development and implementation for monitoring Posyandu data in Indonesia: a 3-year hybrid action study to build "a bridge" from the community to the national scale.', *BMC public health*, 21(1), p. 1024. doi: 10.1186/s12889-021-11035-w.

Shimizu, S. *et al.* (2010) 'Technologic developments in telemedicine: State-of-the-art academic interactions', *Surgery*, 147(5). doi: 10.1016/j.surg.2009.11.001.

Smith, A. C. *et al.* (2020) 'Telehealth for global emergencies: Implications for coronavirus disease 2019 (COVID-19).', *Journal of telemedicine and telecare*, 26(5). doi:

Indonesian Journal of Health Administration
(Jurnal Administrasi Kesehatan Indonesia)
p-ISSN 2303-3592, e-ISSN 2540-9301
10.20473/jaki.v10i2.2022.261-272

10.1177/1357633X20916567.

Soegijoko, S. *et al.* (2011) 'e-health for improving community healthcare: Encouraging clinical experience of simple e-prescription system and m-health system development for mother and childcare', in *2011 IEEE 13th International Conference on e-Health Networking, Applications and Services*. IEEE. doi: 10.1109/HEALTH.2011.6026722.

Suksmono, A. B. *et al.* (2014) 'Overview of telemedicine activities in Indonesia: progress and constraints', in *Proceedings. 6th International Workshop on Enterprise Networking and Computing in Healthcare Industry - Healthcom 2004 (IEEE Cat. No.04EX842)*. IEEE, pp. 1–13. doi: 10.1109/HEALTH.2004.1324464.

Tedeschi, C. (2020) 'Ethical, Legal, and Social Challenges in the Development and Implementation of Disaster Telemedicine.', *Disaster medicine and public health preparedness*. doi: 10.1017/dmp.2020.118.

Tuckson, R. V, Edmunds, M. and Hodgkins, M. L. (2017) 'Telehealth.', *The New England journal of medicine*, 377(16). doi: 10.1056/NEJMsr1503323.

Ventura, C., Gibson, C. and Collier, G. D. (2020) 'Emergency Medical Services resource capacity and competency amid COVID-19 in the United States: preliminary findings from a national survey.', *Heliyon*, 6(5). doi: 10.1016/j.heliyon.2020.e03900.

WHO Telemedicine (2010) '2010 Opportunities and developments Report on the second global survey on eHealth Global Observatory for eHealth series-Volume 2 TELEMEDICINE in Member States', 1(1), pp. 1–13.

Wijaya, V. O., Paramitha, D. and Pinzon, R. (2020) 'Acceleration of Telemedicine Use for Chronic Neurological Disease Patients during COVID-19 Pandemic in Yogyakarta, Indonesia: A Case Series Study', *Kesmas: National Public Health Journal*, 15(2). doi: 10.21109/kesmas.v15i2.3929.