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Implementation of Digital Health in Addressing Global Threats: Lessons from Technology Usage During the COVID-19 Pandemic in Indonesia

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Abstract

A systematic literature review was conducted to explore digital health implementation in Indonesia, focusing on digital health implementations during the COVID-19 pandemic, as well as benefits and lessons learned. A total of 10 relevant journals were identified through database searches and analyzed the trends in publications, productive journals, and top institutions involved in digital health studies. The findings revealed an increasing interest in digital health, with a growing number of published articles from 2021 to 2023. ScienceDirect emerged as the most productive journal, followed by PubMed and MDPI. Universitas Indonesia and Gadjah Mada University were the leading institutions in digital health studies in Indonesia. This study discussed digital health implementation during the pandemic, highlighting its role in epidemic surveillance, telemedicine services, and data systems for COVID-19 management. This study also emphasized the challenges faced in Indonesia's 3T regions (remote areas) due to limited internet access and infrastructure. Overall, the findings contribute to understanding the digital health landscape in Indonesia and provide insights into its benefits and lessons learned.

Keywords: COVID-19, digital health, implementation, pandemic, telemedicine

Introduction

During the Coronavirus Disease 2019 (COVID-19) pandemic in the Southeast Asian region, there was a notable surge in internet usage, resulting in the identification of approximately 40 million new internet users.¹ COVID-19 is drives a significant increase in digital consumption as individuals explore new digital services. According to e-Conomy SEA 2020, the COVID-19 pandemic has led to the rapid growth of two sectors, including health technology.²

Information and communication technology for managing disease and health risks is called digital health. During a pandemic like COVID-19, digital health is not only crucial in preventing the transmission of the virus but is also anticipated to enhance accessibility to health services, minimize inefficiencies in the healthcare system, elevate the standard of care, reduce healthcare expenses, and offer healthcare and independent health tracking capabilities.³

The rapid digital acceleration has significantly influenced digital services, as 94% of newly acquired consumers express their intention to continue utilizing these services even after the pandemic subsides.⁴ The pandemic has hastened the development of digital medical services to provide affordable and accessible healthcare.⁴ Indonesia, as a Southeast Asian nation, faces challenges in terms of limited hospital accessibility and inadequate insurance coverage for digital health services. Consequently, leveraging digital technology in the realm of healthcare presents a viable solution to address health-related issues beyond the COVID-19 pandemic.⁵

The Blueprint for Digital Health Transformation Strategy 2024 outlines a schematic representation of key undertakings in health technology transformation, with a focal emphasis on three priority activities: the integration and advancement of health data systems, the integration and advancement of health application systems, and the establishment of digital health ecosystems.⁶ The Indonesian Ministry of Communication and Informatics issued Decree No. 171 of 2020, which pertains to establishing the *PeduliLindungi* mobile application to facilitate health surveillance efforts for managing COVID-19. The decree designates the *PeduliLindungi* application as a complementary tool to aid in COVID-19 health surveillance.⁷

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The implementation of the One Data initiative, as emphasized in the Indonesian Ministry of Health Regulation No. 21 of 2020, aims to improve the integration, interoperability, and utilization of government data. This initiative goes beyond internal use among institutions and also strives to meet the data needs of the public for the betterment of the community.⁸ To maximize the efficacy of the *PeduliLindungi* application during the new normal era, Regulation No. 18 of 2022 by the Indonesian Ministry of Health mandates the implementation of One Health sector data through the Health Information System. Additionally, this regulation entails the incorporation of pertinent features and updates into the *PeduliLindungi* application, incorporating the concept of One Health.⁹

Based on this background, the authors embarked on a literature review to compile diverse studies focusing on enhancing digital transformation for optimal improvements. This study's primary objective was to garner a theoretical foundation and insights concerning digital health in Indonesia. This study involved a comprehensive examination of various aspects related to digital health in Indonesia. This included analyzing the implementation of digital health policies, the usage of digital health technologies during the COVID-19 pandemic, the benefits and advantages linked to the adoption of digital health solutions, and the valuable lessons learned from the experience of implementing digital health measures during the COVID-19 pandemic in Indonesia.

Method

This study employed a descriptive design and utilized a systematic literature review as its chosen methodology. A systematic literature review involved a rigorous and methodical examination of structured knowledge, ideas, or findings from previous studies that pertain to a specific subject. The primary goal of this study was to address study inquiries and provide solutions to the formulated study issues.

The objectives and questions were designed to align with the practical purpose of the systematic literature review, which was to gain a comprehensive understanding of digital health studies in Indonesia. This included exploring digital health implementation during the COVID-19 pandemic, identifying the benefits of adopting digital health solutions, and deriving insights from the experiences of implementing digital health measures in Indonesia during the COVID-19 pandemic. These objectives give rise to the following extensive study questions, such as: 1) How is digital health implemented in Indonesia? 2) What are the benefits and lessons learned from the implementation of digital health during the pandemic in Indonesia?

The literature search used search engines and databases, including Scopus, SAGE, ScienceDirect, ProQuest, and Portal Garuda. Data collection was performed by accessing the predetermined databases and conducting searches using keywords and Boolean operators (OR, AND, OR NOT, or AND NOT) to expand and specify the search, thus facilitating the identification of relevant journals or articles to be utilized. The database search utilized strings based on titles/abstracts and MeSH terms, serving as an initial step to explore study activities in the desired field and guide more focused study. The final Boolean search queries for this study were conducted on 10 June 2023.

At this stage, relevant articles and studies were selected, and the gathered literature was evaluated against the predefined inclusion and exclusion criteria aligned with this study's questions and objectives. The literature that met these criteria proceeded to the next screening phase. The inclusion criterias for the study are literature focuses on digital health; literature was written in Indonesian language or English; literature fell under the publication type of original, peer-reviewed, and published papers; the intervention in the study was related to the implementation of digital health; literature with or without a comparison of interventions was accepted; literature that could address study questions regarding the implementation of digital health during the pandemic in Indonesia; and literature published after January 2020. The exclusion criterias for this study are literature published in languages other than Indonesian language or English; literature fell under the publication type of editorial, interviews, commentaries, unstructured observations, and position papers; literature discussing the implementation of digital health during the pandemic in countries other than Indonesia; and literature published before January 2020. The literature was screened according to the inclusion and exclusion criteria.

In the selection process, irrelevant studies based on the title and abstract were excluded. However, in cases where there was uncertainty about whether to exclude a study, it was accepted for full-text screening. To ensure agreement among the authors, any discrepancies in their decisions were resolved through a consensus-building process.

The data identification involved searching, selecting, and assessing literature through online databases using predefined keywords. The literature assessment began with title selection, abstract screening, full-text view, and an examination of the objectives, methods, and findings. Subsequently, data extraction was performed from the identified literature by summarizing key points into an extraction table. This process allowed for the synthesis of extracted findings presented in the table. The synthesis stage involved consolidating the presented data into a cohesive set of study results.

The systematic selection and mapping process of all included reviews in the study followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) flowchart, adhering to established standard data extraction

tools. The collected data underwent analysis and was summarized narratively, employing descriptive statistics presented in tables or graphs for each study objective. Microsoft Excel was utilized for calculating descriptive statistics and visualizing spatial data.

Results

A structured search through search strings based on the conceptual framework yielded 368,357 studies on implementation, 60,425 articles on digital health, and 2,568 publications on COVID-19 in Indonesia. The final Boolean search operation resulted in the identification of 58,626 relevant studies encompassing all three conceptual frameworks. The structured search strategies utilized in this study were based on MeSH Terms and included search strings related to implementation, digital health, and COVID-19 in Indonesia. The search string for each item are 1) “Implementation” OR “Health Plan” OR “Social Planning”; 2) “Digital Health” OR “eHealth” OR “Telemedicine” OR “Mobile Health” OR “Health Apps”; and 3) “COVID-19 in Indonesia”.

From the initial pool of 58,444 studies, 49,701 duplicates were identified and removed. During the first selection stage, 8,879 studies were excluded based on title and abstract screening. Subsequently, in the second stage of full-text appraisal, 36 studies were further excluded. As a result, Figure 1 depicts the PRISMA flow diagram representing the final selection of ten reviews subjected to data extraction.

In this study, a standardized data extraction tool was employed to perform data mapping on all 10 reviews. The main objective was to assess the level of evidence provided by each review regarding all six endpoints. The results of this data mapping can be found in this URL (Appendix 1). This study identified ten journals that discuss digital health implementation in Indonesia. To answer the first and second study questions, a descriptive analysis was carried out to observe trends in published scientific articles, journals, and institutions actively involved in research in the field. Figure 2 illustrates the trend of increasing numbers of reviews over time. The data shows only one publication in 2021, but the number of reviewed articles grew to five in 2022.

Figure 2 shows that published articles increased from 2021 to 2023. This growth reflected the interest of academics and researchers in digital health. The growing trend also indicated that this trend will continue to increase in the coming years. Figure 3 displays the ten journals that have disseminated articles concerning digital health implementation in Indonesia during the COVID-19 pandemic. It was observed that ScienceDirect was the top journal with four publications in the field, followed by PubMed and MDPI with two articles each.

An exhaustive database search revealed that Universitas Indonesia and Gadjah Mada University stand out as the prominent institutions actively involved in conducting research related to the implementation of digital health in

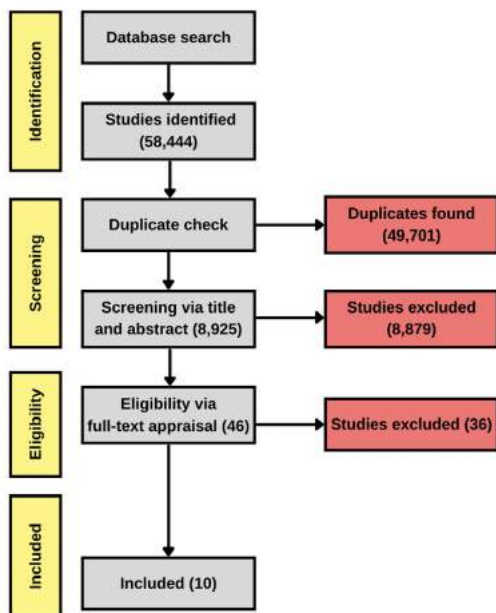


Figure 1. PRISMA Flow Diagram of the Selection

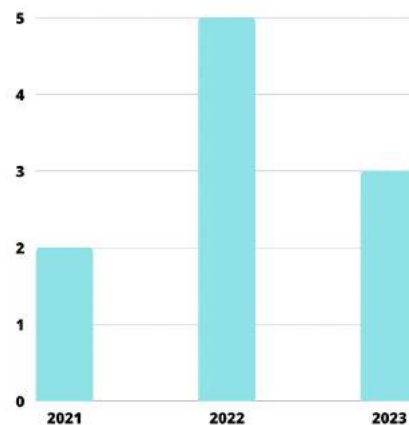


Figure 2. Simple Bar Chart Displaying the Number of Included Reviews by Year of Publication (n = 10)

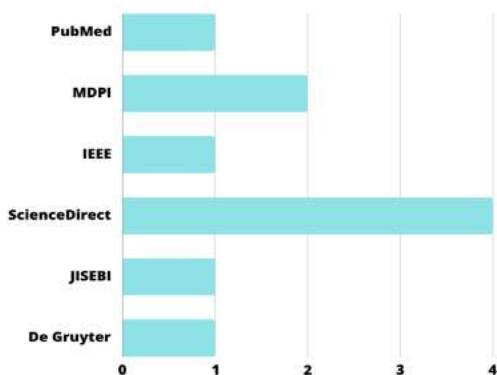


Figure 3. Most Productive Journals (n = 10)

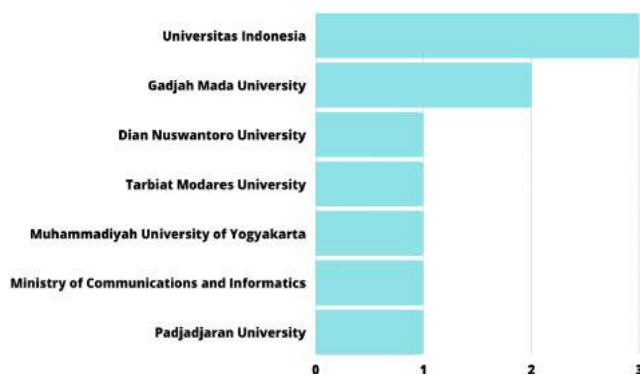


Figure 4. Top Institutions (n = 10)

Indonesia during the COVID-19 pandemic. Universitas Indonesia has contributed a total of three publications, while Gadjah Mada University has published two papers on this subject. It is worth noting that both of these institutions are based in Indonesia. Interestingly, this study also identified Tarbiat Modares University, an institute located in Tehran, Iran, as a contributor to the literature. Figure 4 illustrates the other institutions that made it to the top ten literature findings list.

Discussion

Digital Health Implementation During the COVID-19 Pandemic in Indonesia

Digital health plays a crucial role in improving the efficiency of health systems and expanding the availability of health services while maintaining affordability, which contributes to the advancement of universal health coverage. One such example is the enhancement of patient accessibility through digital interventions.¹⁰ Digital health is utilized in epidemic surveillance as a highly effective approach to mitigate the transmission of COVID-19, as it enables swift and precise detection of infected individuals.¹¹ In China, collaborative efforts between government agencies and internet companies have resulted in the development of diverse applications for real-time monitoring of public health and individual behaviors. These applications are designed to accurately track and manage people’s movements to enhance public health management.¹² Mobile data can serve as a crucial tool for tracking people’s movements, aiding in identifying potential areas where the disease might spread.¹³

The partnership between the Indonesian Ministry of Health and eleven telemedicine platforms provided various services to COVID-19 patients, such as information services, consultations with doctors, and free delivery of medications. Digital health service applications across different provinces in Indonesia are classified into three groups: health services (comprising 63 services), health information systems (consisting of 82 systems), and helpdesk or customer management systems (including 51 types).¹⁴

Furthermore, to support patient treatment, two healthcare data systems have been developed, namely SIRANAP (inpatient information system) and Blood Plasma Donor. These digital technologies have been created through collaborative efforts involving the government, universities, and private sector partnerships, reflecting a multisectoral approach.¹⁵ Throughout the COVID-19 testing phase, a comprehensive New All Record database, SILACAK, was established as an integrated system for recording COVID-19 test results and linking them with the national civil registration system.

Simultaneously, the Indonesian Ministry of Health introduced a telemedicine service to cater to COVID-19 patients who were self-isolating at home in response to the increased demand for consultations and the limited capacity of healthcare professionals to provide in-person consultations. The primary objective of this telemedicine service was to provide remote medical support to individuals in need during the pandemic.¹⁶

Implementing telemedicine in 3T/tertinggal, terdepan, terluar region (remote areas) faces various limitations, such as inadequate internet access, absence of a hospital management information system, strict telemedicine regulations and policies, health data protection commitment, HR constraints, and a lack of integrated systems. Nonetheless, the prospective success of telemedicine implementation in the 3T region is substantiated by the preexisting internet connectivity in most health facilities, coupled with the unwavering commitment of both the government and the private

sector to developing healthcare applications and regulations. According to a previous study, there were 13,011 health facilities, including 2,877 hospitals and 10,134 primary health care in 2019.¹⁷ Among these, 3,126 health service facilities (24.03%) did not have internet access.¹⁷ Despite this, people in the region have shown a growing interest in using the internet for health services, with 51.06% using it to find health information and 14.05% seeking consultations with health experts.¹¹⁷

Recently, there has been significant engagement from both the government and the private sector, particularly Indonesian startups, to advance the life science and healthcare domain. The primary focus of these efforts is to enhance healthcare services and accessibility while also integrating patient information. Additionally, the commitment aims to address potential challenges in the future healthcare industry proactively. This dedication has resulted in the development of numerous applications as concrete outcomes. Notably, the government has introduced applications like JKN Mobile, Digital Claim Verification, and Digital Acquired Immune Deficiency Syndrome Application, among others. Similarly, the private sector has contributed with applications such as Alodokter, GO-MED, Halodoc, K24Klik, KlikDokter, and others.¹⁷

Benefits and Lessons Learned from the Implementation of Digital Health During the Pandemic in Indonesia

The COVID-19 pandemic has imposed restrictions on regular community health services. Consequently, a pressing need for a flexible and inventive digital strategy within the health technology ecosystem has arisen.¹⁸ Digital health literacy indicated the community's preparedness to embrace the digitization of the healthcare system. This aspect is of utmost importance due to the widespread dissemination of information through social media and the internet, which has led to the emergence of infodemics and consequently the dissemination of misinformation about COVID-19.

Such infodemics can worsen the pandemic as it becomes challenging for the public to access reliable sources to make well-informed health decisions, adversely affecting their overall health. To combat this, it is crucial to filter the infodemics through health literacy, specifically focusing on digital health literacy (DHL). A previous study revealed that all digital competence scores were below 4, highlighting the need for improvement in this area.¹⁹ Low digital literacy reinforced infodemics. A DHL score of 4 indicated that the community needs guidance to engage in digital activities. The lowest competencies observed were in health-related content creation and safety, highlighting areas that require improvement to empower the community to navigate digital information responsibly during a pandemic.¹⁹

Age plays a pivotal role in acquiring and utilizing new technologies, owing to the physiological, cognitive, and sensory changes accompanying the aging process.²⁰ The elderly population often encounters difficulties embracing new technologies due to their limited technological proficiency. In contrast, younger generations, exposed to technology early on, form positive attitudes and beliefs, fostering a greater willingness to explore and employ novel technologies. Early exposure engenders a heightened comfort level with technology among the younger cohort, facilitating their seamless adaptation to emerging technological innovations.²⁰ Furthermore, individuals with more experience are likely to harbor favorable attitudes toward technology and acquire the necessary skills and knowledge to use it effectively. Conversely, those with less experience may require additional support to achieve proficiency and may exhibit reduced inclination toward technology adoption in the future.²⁰

A study centered around nurses working in the outpatient department of a private hospital in western Indonesia found that 76% of the participating nurses perceived their level of knowledge concerning telemedicine operations to be moderate.²¹ The study findings underscore the need to improve nurses' knowledge and proficiency in telemedicine, which can be achieved through education, training, and practical experience. By implementing telemedicine training programs, nurses are anticipated to enhance their understanding and confidence in utilizing telemedicine, ultimately fostering a positive attitude toward this innovative healthcare concept.²¹

A study focused on understanding the influence of user behavior and technological dimensions on the intention to use telemedicine applications in Indonesia found that various factors positively and significantly influence individuals' intention to use hospital telemedicine applications. These factors include the desire to avoid contamination, concerns about security and reliability, the perception of professionalism, ease of use, perceived benefits, and the quality of information the telemedicine applications provide.²²

According to a previous study, most health professionals believe that healthcare applications can enhance their service activities with some improvements.²³ For example, the application should be accessible through smartphones since the surveyed health professionals express the belief that smartphones can facilitate their day-to-day tasks. If the application is intended for use in Indonesia, it is advisable to utilize and adapt the Indonesian language to Indonesian culture. This adaptation is deemed important by most health professionals in the study, as they perceive that linguistic and cultural customization can make the application usage process easier.²³

According to user feedback from the prototype assessment, the average evaluation score for the application's pro-

tototype, considering all material aspects, was 4.7, corresponding to a high 94.2% approval rate. These results suggested that the educational content and its implementation in the app were considered appropriate for patient education.²⁴

Conclusion

This study emphasizes the importance of implementing digital health solutions in Indonesia during the COVID-19 pandemic. The integration of digital health technologies has proven to be crucial in enhancing the efficiency of the healthcare system, facilitating remote healthcare services, and bolstering epidemic surveillance through mobile applications and contact tracing tools. Collaboration between the government and telemedicine platforms has provided various digital health services, benefiting COVID-19 patients and supporting resource allocation. However, challenges in infrastructure and equitable access to digital health services persist, particularly in remote areas. Addressing these challenges and formulating supportive policies are essential to optimize digital transformation strategies and improve healthcare access in Indonesia in the future.

Abbreviations

COVID-19: Coronavirus Disease 2019; PRISMA: Preferred Reporting Items for Systematic Reviews and Meta-Analyses; DHL: Digital Health Literacy.

Ethics Approval and Consent to Participate

Not Applicable.

Competing Interest

The authors declared no significant competing financial, professional, or personal interests that may affect the performance or presentation of the work described in this manuscript.

Availability of Data and Materials

All data and materials pertinent to the exemplary systematic review are publicly accessible through various databases, such as Scopus, SAGE, ScienceDirect, ProQuest, and Portal Garuda. Appendix 1 can be accessed here.

Authors' Contribution

NS was responsible for the manuscript, conceptualization, method (search strategy, study selection criteria, selecting studies, extracting studies, data analysis), and results; AT was responsible for conceptualization, introduction, analysis of the data, and results; KNS provided input and suggestions on the entire article.

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Not Applicable.

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