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Utilization of Digital Technology to Improve Access and Quality of Primary Health Care in Indonesia

(Opportunities and Challenges in the Indonesian Health System: A Systematic Literature Review)

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Abstract

Primary health care is the foundation of the national health system, especially for reaching underserved and remote populations. In Indonesia, challenges persist in ensuring equitable access and improving the quality of primary care services. Digital technology offers a promising solution through platforms such as telemedicine, electronic medical records, and mobile health applications. However, its adoption is uneven due to infrastructure limitations, digital literacy gaps, and unclear regulatory frameworks. This study explores how digital technology can improve access and quality in Indonesia's primary health care system through a Systematic Literature Review (SLR). Peer-reviewed articles from 2015 to 2024 were analyzed using the PRISMA protocol, sourced from Google Scholar, PubMed, and ResearchGate. The keywords used included digital health, telemedicine, primary health care, and health access. The findings show that digital technologies enhance service efficiency, expand outreach, and support remote consultations. Tools like mobile-based education and telemedicine have proven beneficial in strengthening primary care delivery. However, persistent challenges include inadequate digital infrastructure, limited training for health workers, and the absence of integrated policy frameworks. To fully harness digital health's potential, Indonesia must invest in infrastructure, improve digital literacy, and strengthen regulations. These steps are essential for ensuring sustainable and equitable improvements in primary health care delivery.

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Introduction

Primary health care services represent the frontline of the health system and play a pivotal role in improving population health outcomes. In Indonesia, primary health care is particularly critical for reaching diverse populations, including those residing in remote, rural, and archipelagic regions. Despite its strategic role, however, the quality and accessibility of primary health care remain challenged by multiple factors, such as the unequal distribution of health workers, limited infrastructure, and insufficient public health education and information. In response to these issues, digital transformation in health services has emerged as an innovative solution increasingly adopted by the government and health institutions to enhance access, efficiency, and service quality.

The utilization of digital technologies in the health sector has accelerated markedly since the onset of the COVID-19 pandemic. The pandemic compelled all levels of health services to rapidly adapt to technology-based solutions, including communication, consultation, and medical data management. One of the most prominent manifestations of this transformation is the widespread adoption of telemedicine, which enables remote health consultations through digital platforms. In Indonesia, telemedicine initiatives have gained increasing recognition, exemplified by the system developed by the Agency for the Assessment

and Application of Technology (BPPT), which underscores the importance of medical data authenticity in digital health processes (Agastani et al., 2018).

Furthermore, health education and promotion also shifted toward digital formats during the pandemic. For example, in Sleman District, health education programs that were traditionally conducted face-to-face were transformed into digital modes to ensure continuity amid mobility restrictions (Aisyah et al., 2023). This evolution illustrates that health digitalization is not confined to curative services but also extends to promotive and preventive aspects of primary health care.

Nevertheless, the effectiveness of digital technology implementation is highly dependent on the readiness of communities as the primary users. In the context of telemedicine, for instance, public perception and knowledge are decisive factors influencing its effectiveness. Studies reveal that some communities continue to doubt the quality of online health services and lack adequate understanding of the procedures involved (Budiman et al., 2023). Therefore, strengthening digital literacy and community education remains a critical requirement for successful transformation.

Health care providers are similarly required to adapt to these technological developments. A central challenge lies in the management and security of Electronic Medical Records (EMRs). In the digital era, EMRs are indispensable as they facilitate efficient and sustainable integration of patient data. However, EMR systems are also vulnerable to breaches of confidentiality, thereby necessitating the adoption of robust security measures such as authentication, access control, and encryption—standards exemplified by the Digital Transformation Office (DTO) of the Indonesian Ministry of Health (Indriyajati et al., 2023).

Digital transformation has also extended to managerial and administrative domains of health care. A study on the online registration process for Indonesia's National Health Insurance (BPJS) demonstrated that digital bureaucracy enhances service efficiency, although it requires stable systems and adequate policy support to operate effectively (Hidayat et al., 2021). Such digital integration aligns with the essential needs of primary health care, which must remain timely, accurate, and accessible to all citizens without excessive procedural burdens.

At the level of educational institutions, preparing future health professionals for the digital era is equally vital. Faida and Angesti (2023) highlighted that institutions for health record and information management must revise curricula and strengthen infrastructures that foster digital competencies among graduates. This readiness is indispensable to ensure that human resources in the health sector can adopt and apply digital technologies effectively and safely. Beyond access and efficiency, digital health technologies also enable large-scale health data analytics for evidence-based policy planning. For instance, the application of machine learning in predicting disease incidence in Indonesia illustrates the concrete use of artificial intelligence in public health (Wardhana et al., 2023). Such innovations not only support clinical decision-making but also strengthen public health interventions by targeting them more precisely.

Nonetheless, digital disruption also presents substantial challenges for hospitals and primary health care facilities as service providers. According to Laksono (2022), hospitals in Indonesia face significant barriers to technology adoption, particularly with respect to human resources, infrastructure, and organizational culture. Similar issues are evident in community health centers and primary clinics, many of which lack standardized document management systems such as ISO 15489 (Dzikria et al., 2022).

From a managerial perspective, improving patient care quality has emerged as a key priority in the digital transformation era. Rosita (2023) emphasizes that hospital management must devise innovative, digitally integrated strategies to strengthen patient satisfaction and service outcomes. Such strategies include training health workers, implementing reliable information systems, and establishing data-driven monitoring and evaluation mechanisms.

Despite the considerable promise of digital health technologies, their success relies on strong collaboration among multiple stakeholders. The government plays a pivotal role in providing adaptive regulations and expediting the development of digital infrastructures across Indonesia. Meanwhile, health professionals must continuously enhance their technological competencies, and communities must be encouraged to advance their digital and health literacy.

Taken together, evidence from prior studies indicates that digital technologies hold great potential to improve both access to and the quality of primary health care in Indonesia. However, their implementation must be structured, inclusive, and sustainable, taking into account the readiness of all stakeholders. Digitalization of health care is no longer an option but a necessity that must be implemented comprehensively. Within the context of primary health care, this transformation represents a strategic effort to bridge service disparities between urban and rural areas as well as between middle-class and vulnerable populations. Only through collaborative, evidence-based approaches can Indonesia achieve a more equitable, efficient, and resilient primary health care system in the digital era.

Although previous studies indicate that digital technologies have significant potential to improve access to and the quality of primary health care in Indonesia, their implementation still faces several critical

challenges. One major issue is the lack of understanding regarding the readiness of various stakeholders, including health care providers, patients, and facility managers, to effectively adopt digital technologies. Additionally, existing literature largely emphasizes the potential and benefits of digital solutions but provides limited discussion on structured, inclusive, and sustainable implementation strategies in the local Indonesian context. Another knowledge gap is the lack of empirical evidence on the tangible impact of digitalization in reducing service disparities between urban and rural areas, as well as between middle-class and vulnerable populations. Therefore, a systematic review is needed to identify, analyze, and synthesize current evidence on the implementation of digital technologies in primary health care, providing a solid foundation for more equitable, efficient, and resilient policy and practice strategies.

Methods

This study adopted a Systematic Literature Review (SLR) approach to explore and analyze scientific findings on the utilization of digital technologies for improving access to and the quality of primary health care services in Indonesia. The SLR method was selected because it enables a structured and comprehensive synthesis of prior research while facilitating the comparison of diverse perspectives and approaches to health service digitalization, particularly within the context of primary care, which serves as the focus of this study.

The literature search and analysis were conducted in accordance with the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines. PRISMA provides a transparent framework covering four stages: identification, screening, eligibility, and inclusion of studies. Following this framework, the researchers first identified potentially relevant articles from various online databases, screened them against predefined inclusion criteria, and subsequently conducted full-text analyses of eligible articles.

Literature sources were retrieved primarily from Google Scholar and ResearchGate. The search strategy employed specifically formulated keywords such as “digital health technology,” “telemedicine in Indonesia,” “primary health care,” “electronic medical records,” and “digital transformation in health services.” These keywords were used in both Indonesian and English to ensure broader coverage of relevant references. The search was limited to studies published between 2015 and 2024 to capture recent developments in digital health applications.

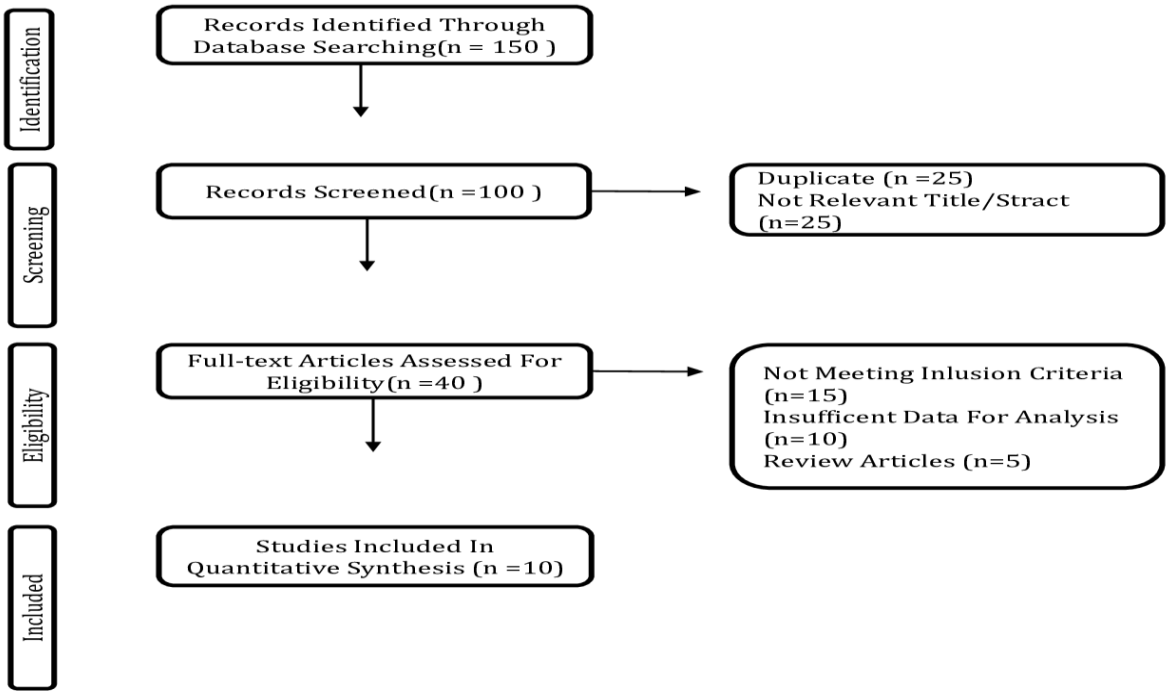
The inclusion criteria comprised studies that: (1) focused on the application of digital technologies in primary health care services; (2) were written in Indonesian or English; (3) were published in accredited scientific journals or reputable national journals; and (4) contained either empirical findings or relevant conceptual analyses. Exclusion criteria eliminated non-scholarly materials such as opinion pieces, news articles, or purely technical discussions without direct relevance to health services.

The selection process was performed systematically. Initially, article titles and abstracts were screened for relevance. Full-text reviews were then conducted on those meeting preliminary criteria. To minimize bias and strengthen validity, two independent reviewers conducted the selection process. Any discrepancies were resolved through discussion until consensus was reached.

The final set of included articles underwent qualitative thematic analysis. The content of each study was categorized into key themes, including: (1) types of digital technologies utilized in primary care (e.g., telemedicine, electronic medical records, health applications); (2) purposes of technology use (e.g., improving access, efficiency, service quality, health education); and (3) implementation challenges and barriers. Each theme was critically analyzed to identify recurring patterns, knowledge gaps, and contributions to the development of digital health services in Indonesia.

The thematic findings were synthesized into a comprehensive narrative that highlights the current state, potential benefits, and policy recommendations for integrating digital technologies into Indonesia’s primary health care system. This approach aims to generate an evidence-based understanding of how digital transformation can serve as a strategic pathway to strengthen and modernize primary health care delivery in Indonesia.

Results



PRISMA Flow Diagram Of The Article Selection Process

Table 1. Summary of Reviewed Studies

No	Author(s)/Year	Title of Study	Research Design	Key Findings
1	Agastani, T., Iqbal, M., Kusuma, A. A. N. A., & Purnaadi, C. (2018)	Engineering of a Module to Ensure the Validity of Medical Data in BPPT Telemedicine System Innovation	Design-engineering and telemedicine system testing using virtual testbeds	The module effectively ensures data validity (tele-ECG, ultrasound, consultation) under limited network conditions
2	Aisyah, L., Wastutiningsih, S. P., & Sulastri, E. (2023)	Dynamics of Digital Health Counseling Transformation During the COVID-19 Pandemic in Sleman Regency	Qualitative case study (in-depth interviews and literature review)	Three phases of transformation: slow pre-pandemic adoption, mass digital shift during the pandemic, and hybrid adaptation; barriers included digital divide, cultural factors, and limited human resources
3	Dzikria, I., Narulita, L. F., & Hermanto, A. (2022)	Implementation of the ISO 15489 Standard to Support Digital Transformation of Health Services at Pratama Menganti Clinic	Implementation study (field service)	Digital document management standards were implemented, supporting accreditation and service efficiency
4	Faida, E. W., & Angesti, D. (2023)	Readiness of Health Information and Medical Record Educational Institutions in the Digital Transformation Era Based on UTAUT	National seminar evaluation (quantitative post-test data)	Participants demonstrated significant improvement in UTAUT understanding, and increased digital EMR readiness
5	Hidayat, A., Menanda, I. D., &	Analysis of BPJS Kesehatan Online	Descriptive qualitative study	Online procedures simplified registration,

No	Author(s)/Year	Title of Study	Research Design	Key Findings
	Putri, L. F. E. (2021)	Registration Procedures as a Form of Bureaucratic Digital Transformation in Indonesia		though challenges remained in digital literacy and information dissemination
6	Indriyajati, F., Jawa, M. M. S. D., & Utomo, H. (2023)	Data Security Analysis of Electronic Medical Records at the Digital Transformation Office (DTO) of the Indonesian Ministry of Health	Secondary document analysis (strategy documents and annual reports)	Recommended stronger security measures: authentication, access control, and encryption for EMRs
7	Laksono, S. (2022)	Digital Health and Digital Disruption in Hospital Services	Literature and policy study	Digitalization caused service disruption, highlighting the need for infrastructure upgrades and HR capacity building
8	Rosita, N. P. I. (2023)	Hospital Management Strategies to Improve the Quality of Patient Services	Literature review	Strategies included quality management, government-investor collaboration, HR training, and regular patient satisfaction surveys
9	Wardhana, R. G., Wang, G., & Sibuea, F. (2023)	Application of Machine Learning in Predicting Disease Case Rates in Indonesia	Quantitative study – ML modeling (decision tree)	The decision tree model achieved high accuracy in predicting disease case rates
10	Budiman, S. V., Ratag, G. A. E., & Wahongan, G. J. P. (2023)	Qualitative Analysis of Public Perceptions and Knowledge of Telemedicine	Qualitative study (in-depth interviews)	Positive perceptions included broad access and affordability; barriers included weak internet connection and lack of pharmacy integration

Based on the review of the ten scientific articles summarized in the table above, it can be concluded that digital transformation in Indonesia's health sector has undergone significant development across multiple dimensions. The studies reviewed range from telemedicine system engineering (Agastani et al., 2018), the readiness of health education institutions (Faida & Angesti, 2023), to the implementation of electronic medical data security standards (Indriyajati et al., 2023). Most of these works employed qualitative approaches or implementation studies to analyze the challenges and impacts of digitalization from both community and institutional perspectives. Overall, the findings indicate that digitalization has the potential to enhance efficiency, accessibility, and service quality, although challenges remain in the areas of digital literacy, infrastructure readiness, and regulatory frameworks. Furthermore, the adoption of advanced technologies such as machine learning and ISO-based document management systems is part of the broader transformation that supports improved health services and evidence-based decision-making. Collectively, this body of literature highlights that successful digital transformation in health care requires synergy among technology, policy, and human resource capacity.

Based on the review of ten scientific articles on digital transformation in Indonesia's health sector, it is evident that digitalization has developed significantly across multiple dimensions, including telemedicine, the readiness of health education institutions, and the implementation of electronic medical data security. However, several problems remain unaddressed. First, most studies emphasize the potential benefits of digital technologies but provide limited discussion on structured, inclusive, and sustainable implementation strategies in the Indonesian context. Second, there is a lack of empirical evidence regarding the impact of digitalization on reducing service disparities between urban and rural areas, as well as between middle-class and vulnerable populations. Third, the majority of existing studies employ qualitative or limited implementation approaches, resulting in the absence of a comprehensive synthesis that integrates findings across different perspectives.

Discussion

(1) Knowledge

The effective utilization of digital technology in health services cannot be achieved without adequate knowledge from two main actors: health workers as service providers and the public as users. Knowledge is not limited to technical proficiency with devices and systems but also encompasses a comprehensive understanding of operational procedures, short- and long-term benefits, potential risks, and information governance in accordance with ethical and legal standards. In the context of digital transformation, knowledge serves as a key determinant of readiness and successful adoption at both the micro (individual) and macro (institutional) levels.

For example, systems such as telemedicine, electronic medical records (EMRs), and mobile-based digital health applications remain relatively unfamiliar to many, particularly in areas with low digital literacy or limited access to technology. A lack of understanding of how applications function, the security of patient data, and the legitimacy of services often leads to resistance or misuse. Such conditions can reduce service quality or widen gaps in access between regions. Budiman et al. (2023) observed that public perception of telemedicine remains marked by skepticism and doubt, especially among elderly populations and those with lower educational attainment. This indicates that the mere availability of infrastructure is insufficient without efforts to improve digital literacy and functional understanding of technology.

From the perspective of health workers, knowledge of digital systems is no longer an additional skill but a core competency in modern clinical practice. As highlighted by Agastani et al. (2018), the validity of data within telemedicine systems depends heavily on the accuracy and consistency of inputs by medical staff. Even small errors in data entry may compromise diagnostic quality, undermine data integrity, and harm patients. Therefore, training must be continuous, competency-based, and contextually adapted to field needs, particularly in primary care settings that face unique challenges.

Equally important is institutional knowledge, which plays a pivotal role in the success of health sector digitalization. Educational institutions must adapt curricula to align with technological advancements. Faida and Angesti (2023) emphasized that uneven integration of digital skills in academic environments often leaves graduates unprepared for field realities, leading to confusion, slower adaptation, and lack of confidence when engaging with digital systems. Hence, hands-on training through simulations, case-based learning, and community-based digital service programs is essential. Comprehensive knowledge, both at the individual and institutional levels, is thus the foundation for building a digital health ecosystem that is not only modern and efficient but also sustainable, equitable, and inclusive.

(2) Income

Income is a structural determinant that significantly affects access to digital health services at both individual and institutional levels. Low-income groups often face barriers in accessing devices, internet connections, and online health services such as teleconsultations or electronic medical records. Laksono (2022) highlighted that income disparities across regions in Indonesia have resulted in unequal adoption of digital health services, with urban areas benefitting more than rural or remote communities.

At the institutional level, the implementation of digital systems requires considerable investment in hardware, software, and staff training. Rosita (2023) noted that many hospitals and health centers with limited budgets face difficulties in adopting standardized digital systems, leading to inefficiencies in service delivery, patient data accuracy, and inter-unit integration. To address this, the Ministry of Health, through the Digital Transformation Office (DTO), has provided funding mechanisms, regulatory frameworks, and capacity-building initiatives. Indriyajati et al. (2023) further stressed that successful implementation of digital data protection systems in health care relies heavily on sustainable financial support and consistent policy commitment. Thus, the success of digitalization in primary health care is not solely a matter of technological readiness but also of equitable and responsive financial governance.

(3) Behaviour

Behavioral change is one of the greatest challenges in adopting digital technology in health care. Both health workers and the public must shift from traditional habits to new patterns of interaction compatible with digital ecosystems, such as using online consultations, adapting to application-based administrative processes, and engaging with electronic medical records.

However, this change is not automatic. Aisyah et al. (2023) found that the effectiveness of digital health counseling during the COVID-19 pandemic was strongly influenced by the ability to adapt implementation strategies to local contexts, including cultural norms and community readiness. This suggests that behavioral interventions cannot be uniform but must be tailored to socio-cultural and economic conditions.

Bureaucratic behavior also influences adoption. Hidayat et al. (2021) reported that although digital systems for BPJS registration were available, many still preferred conventional methods. This reflects a lack of public trust in digital platforms, which can be addressed not only by infrastructure provision but also by effective communication, risk management, and positive user experiences.

For health workers, behavioral adaptation is equally crucial. Dzikria et al. (2022) emphasized that discipline and commitment in adhering to ISO 15489-based digital document management systems are critical for effectiveness. Without behavioral transformation, even advanced systems cannot deliver optimal results. Therefore, behavior change must be treated as an integral component of digital health implementation strategies.

(4) Security and Trust

Data security is the cornerstone of sustainable digital health services. Medical information is highly sensitive, and breaches can severely erode public trust. Indriyajati et al. (2023) stressed that protecting data within the Electronic Medical Record (EMR) system is a central priority of the Ministry of Health's DTO in building a trustworthy digital infrastructure.

Trust, however, does not emerge instantly. Negative experiences, such as data leaks or unresponsive health applications, can quickly diminish public confidence. Faida and Angesti (2023) argued that trust in digital services is shaped not only by technical safeguards but also by user literacy and prior positive experiences. Therefore, ensuring cybersecurity requires transparency, accountability, and clear communication in addition to robust technical measures.

Strengthening trust also involves creating inclusive systems accessible to all segments of society. Public education on data rights and responsive grievance-handling mechanisms are crucial for fostering confidence. In this regard, security and trust are not supplementary but essential strategic pillars for the success of digital health care.

Conclusion

Digital transformation in Indonesia's healthcare sector is a complex process involving technology, human resources, institutions, and policy. Literature analysis indicates that the success of digitalization is determined by four key factors: healthcare workers' digital competence, public digital literacy, institutional readiness, and data security that fosters public trust. Digital competence and literacy influence the effective use of telemedicine, electronic medical records, and mobile health applications, while infrastructure and income disparities limit service access. Health workers' discipline and behavioral adaptation are crucial for service quality, and transparency and data protection form the foundation for sustainable digital systems.

Based on these findings, it is recommended that the government strengthen regulations, funding, and policies to ensure equitable access and secure digital services. Educational and training institutions should adjust curricula and provide continuous competency-based training. Health workers must remain adaptive and maintain clear communication with patients. Communities can be supported through digital literacy programs and engagement in community-based health services. A coordinated approach is expected to achieve an effective, inclusive, and sustainable digital health transformation in Indonesia.

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