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Communication as a Technology in Digital Health for Diabetes Management in Indonesia

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Abstract

Background: Diabetes management depends on continuous monitoring, education, and interaction, yet Indonesia faces persistent geographic and workforce-related barriers to equitable access to chronic care. Digital health may reduce these barriers, but communication is often treated only as a delivery channel rather than as an interactive technological component of care.
Objective: This study explored communication practices in digital health for diabetes management in Indonesia, examined communication as a technological function within digital health systems, and developed a communication-as-technology model based on the synthesized evidence.
Methods: A systematic literature review (SLR) was conducted using Scopus and Google Scholar to identify publications from 2020 to 2025. Eligibility was assessed using the PRISMA process, including identification, screening, eligibility assessment, and inclusion. Ten articles that met the review criteria were included in the final synthesis.
Results: The 10 included articles showed that mobile health (mHealth), telehealth, self-management applications, wearable devices, and related digital systems support glucose monitoring, patient education, self-management, and communication with healthcare professionals. Across the evidence, communication operated not only as a means of information transfer but also as a feedback mechanism linking patients, data, algorithms, and healthcare professionals. This function is particularly relevant in Indonesia, where digital channels can partially mitigate geographic and workforce-related barriers to access.
Conclusion: Communication serves as a functional layer of digital health for diabetes management by supporting feedback, interaction, and behavioral change. In Indonesia, successful implementation requires digital literacy, infrastructure, interoperability, privacy, and equitable access. This conceptual model requires further empirical validation.

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INTRODUCTION

Health is one of the most important aspects of human life. Health can also be defined as a condition in which individuals are physically, mentally, socially, and spiritually well. This means that health is not merely the absence of disease but a state of overall well-being. Technological developments and changes in people's lifestyles have also contributed to the increasing prevalence of noncommunicable diseases (NCDs), one of which is diabetes mellitus. Diabetes has become a global health issue that continues to increase in prevalence every year and requires long-term management because it is associated with health complications, quality of life, and the economic burden on society and healthcare systems.

Currently, Indonesia is facing an increasing burden of diabetes. According to the official website of the Indonesian Ministry of Health in 2025, several noncommunicable diseases continue to increase in prevalence each year, including hypertension, diabetes, heart disease, and cancer. According to data from the Basic Health Research (Riset Kesehatan Dasar [RISKESDAS]), the number of people living with diabetes in Indonesia reached approximately 19.7 million in 2021 and was estimated to exceed 20 million by 2024. Meanwhile, the International Diabetes Federation (IDF) stated that, in 2024, the number of people with diabetes in Indonesia reached 20.9 million, with a significant increase predicted through 2045 (Federation, 2021, 2025). Based on data from the official Diabetes Atlas website in 2024, Indonesia ranked fifth among countries with the highest number of people with diabetes worldwide. The high number of diabetes cases in Indonesia indicates that this disease requires more serious attention and management. The scale of this burden makes continuity of monitoring and communication a central issue in chronic care delivery, particularly when patients must manage their condition outside clinical settings.

Diabetes requires routine monitoring, education, and lifestyle changes undertaken by patients. However, the healthcare system in Indonesia still faces various challenges, particularly regarding unequal access to healthcare services across regions. Indonesia has unique geographical challenges, consisting of more than 17,000 islands and 38 provinces. Indonesia's geography more than 17,000 islands across 38 provinces creates substantial challenges for equitable healthcare access. This condition is further exacerbated by the limited number of healthcare workers, which remains below the recommendations of the World Health Organization (WHO). In frontier, outermost, and underdeveloped (*terdepan, terluar, dan tertinggal [3T]*) areas, healthcare facilities and workforce availability remain particularly limited (Bilqis, 2023; Sarjito, 2024).

The limitations of healthcare facilities result in unequal access for people with diabetes to health information, consultation services, and routine disease monitoring. In the context of chronic diseases such as diabetes, limitations in health communication can affect patient adherence to treatment and their ability to self-manage the disease. The development of digital technology has encouraged the emergence of the concept of digital health as an innovation in healthcare systems. The transformation toward digital health, including telemedicine, electronic health records (EHRs), health applications, and wearable devices, presents potential opportunities to bridge limitations in healthcare access (Agrawal & Agbeyangi, 2026; WHO, 2021). In the digital era, communication has evolved into a more complex process involving real-time data, algorithms, and system-based interactions (Hou et al., 2025; Lupton, 2018; Topol, 2019).

In diabetes management, communication is crucial because people living with diabetes must make clinical decisions every day, such as calculating calorie intake and determining the appropriate insulin dose to inject. In addition, people with diabetes who use wearable devices such as continuous glucose monitoring (CGM) systems require real-time data interpretation through algorithms generated by the technology. Furthermore, the continuous development of diabetes technology requires ongoing education and interaction (Bajaj et al., 2026; Powers et al., 2020).

However, in Indonesia, there is still a gap between the development of digital health technology and the conceptual understanding of communication as technology. Most digital health implementations in Indonesia position communication merely as an intermediary tool or a one-way information-delivery medium, rather than as an interactive system capable of shaping patient behavior. Previous studies have shown that the success of digital health is highly influenced by the quality of communication, including aspects such as trust, health literacy, and user interaction (Latulippe et al., 2020; Shaw et al., 2021; Shi & Sit, 2024). Unlike studies that primarily evaluate platform adoption or clinical functionality, this review synthesizes how communication itself performs system-level functions feedback, interpretation, coordination, and behavioral reinforcement across digital diabetes interventions.

Therefore, there is a significant research gap, namely the absence of a conceptual framework that positions communication as a core technological system in digital health, particularly in the context of chronic diseases and developing countries such as Indonesia. The urgency of this research lies in the fact that, without effective and integrated communication, the implementation of digital health may fail to produce behavioral changes in patients and may not significantly affect clinical outcomes (Agrawal & Agbeyangi, 2026; Greenhalgh et al., 2020; Tang

& Smith, 2022; WHO, 2021). This study will also be analyzed using Computer-Mediated Communication (CMC) theory, which examines digital media as a highly flexible system that enables continuous communication without the limitations of space and time. The conceptual contribution is therefore not the claim that communication is newly present in digital health, but rather the reframing of communication as an operational layer through which digital systems convert data and interaction into self-management support. This distinction provides a testable basis for future empirical work in Indonesia.

This study aims to explore how communication practices occur in digital health for diabetes management in Indonesia, how communication functions as technology within digital health systems, and how a communication-as-technology model can be developed based on the findings. This research not only seeks to describe communication practices in digital health but also to explain the role of communication as a technology capable of shaping the behavior of people living with diabetes in managing their disease.

METHOD

This study used the Systematic Literature Review (SLR) method, which is a process of collecting and analyzing the core findings of various valid scientific sources. Rather than collecting primary data directly from the field, this study focused on analyzing and synthesizing findings from previously published studies (Viviana et al., 2025). The research utilized scientific articles indexed in the Scopus and Google Scholar databases. According to Sweileh et al. (2017) and Hafiar et al. (2023), Scopus contains a broader range of documents and data compared with other databases, such as Web of Science and PubMed, and has long served as a major reference source for academics. Furthermore, Manyaga (2023) explained that Scopus integrates more journals and author records than other databases, particularly when reviewers carefully construct search strategies using appropriate keywords to generate optimal results.

The journal articles selected for this study were published within the last five years (2020–2025). This timeframe was chosen in accordance with the objective of the study, namely, to explore communication practices in digital health within diabetes management. To retrieve relevant literature from the Scopus database, the researcher used the following query:

TITLE-ABS-KEY ("Digital Health" AND "Diabetes")

This query was designed to capture various terminological variations used in the digital health literature related to diabetes. Additionally, the researcher limited the search to articles published in English and Indonesian and filtered the document types to include only articles and conference papers in both Scopus and Google Scholar. After retrieving the records from Scopus and Google Scholar, the next step involved screening the articles for eligibility using the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) framework. The PRISMA process consists of identification, screening, eligibility assessment, and inclusion of relevant articles for further analysis. All information obtained from publications related to digital health and diabetes was collected, categorized, and presented descriptively in narrative form. The conclusions of the study were drawn after all relevant data had been analyzed. Records were exported, duplicates were removed, titles and abstracts were screened against the eligibility criteria, and potentially eligible full texts were reviewed before the final evidence table was constructed.

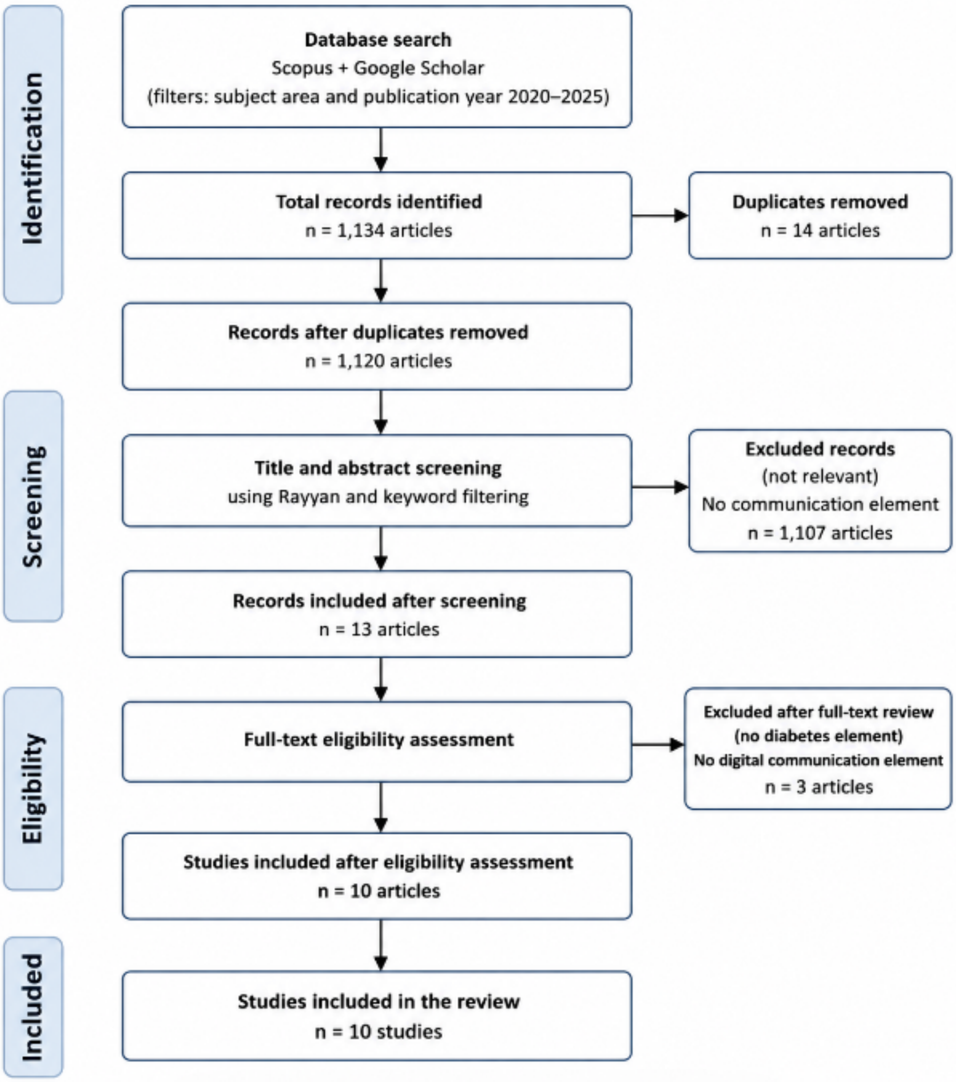

Figure 1. Research Flow

RESULTS AND DISCUSSION

Result

Table 1

Article Characteristics

No	Author (Year)	Title	Methods	Key Findings
1	Lau et al. (2025)	Telehealth and Precision Prevention: Bridging the Gap for Individualized Health Strategies	Review Article	Telehealth and precision prevention support more personalized healthcare through wearable devices, remote monitoring, artificial intelligence, and real-time health data analysis.
2	German et al. (2024)	Interactive visualization tool to understand and monitor health disparities in diabetes care and outcomes	Cohort Study / Tool Development	Interactive visualization tools help communicate complex diabetes health data in a more accessible and understandable way for healthcare professionals, care managers, and policymakers.
3	Brands et al. (2022)	Patient-Centered digital health	Protocol / Stepped	Patient-centered digital health records improve

No	Author (Year)	Title	Methods	Key Findings
		Records and Their Effects on Health Outcomes: Systematic Review	Wedge Pilot Study	communication between patients and healthcare providers, enhance patient engagement, support shared decision-making, and increase access to real-time health information.
4	Kerr et al. (2024)	Digital Interventions for Self-Management of Type 2 Diabetes Mellitus: Systematic Literature Review and Meta-Analysis	Systematic Review & Meta-Analysis	Digital interventions such as mobile health applications, telehealth, and online self-management platforms significantly improve glycemic control, self-management behaviors, medication adherence, and patient engagement.
5	Wilson-Anumudu et al. (2021); Alnahdi et al. (2025)	Early insights from a digitally enhanced diabetes self-management education and support program	Single-Arm Pilot Study	Digitally enhanced DSMES programs improve patient engagement, self-management behaviors, and diabetes education participation
6	Nguyen et al. (2023)	mHealth Intervention for Vietnamese Living With Diabetes: Protocol for a Stepped Wedge Pilot Study	Protocol / Stepped Wedge Pilot Study	Protocol designed to improve diabetes self-management,
7	Bilqis (2023). Tantangan Pelayanan Kesehatan Digital pada Penyakit Kronis di Indonesia. Jurnal Informatika Kesehatan, 14(2), 156-170. Fithriana et al. (2025)	Efektivitas Penggunaan Aplikasi Self Management terhadap Pemantauan Kadar Gula Darah pada Pasien DM Tipe II di Kota Mataram	Quasi-Experiment al Method	The use of the mySugr self-management application effectively helped Type 2 Diabetes Mellitus patients monitor blood glucose levels. The application improved patients' self-monitoring, facilitated access to health records, and supported health consultations, resulting in decreased average fasting blood glucose levels.
8	Bilqis (2023)	Tantangan Pelayanan Kesehatan Digital pada Penyakit Kronis di Indonesia	Descriptive Qualitative	Digital health has strong potential to improve chronic disease management, particularly diabetes care, by increasing healthcare access, patient education, and remote monitoring.
9	Kytö et al. (2022)	Comprehensive self-tracking of blood glucose and lifestyle with a mobile application in the management	Randomized Controlled Trial (RCT)	Improved blood glucose self-tracking compliance and better gestational diabetes management, birth weight outcomes

No	Author (Year)	Title	Methods	Key Findings
		of gestational diabetes		
10	Fernandez-Luque et al. (2021); Greeley et al. (2025)	digital health for Supporting Precision Medicine in Pediatric Endocrine Disorders	Review Article	Digital health technologies such as telemedicine, wearable devices, mobile applications, and artificial intelligence support precision medicine through personalized monitoring, real-time data collection, and continuous communication between patients, families, and healthcare providers.

Use of Digital Health Among Diabetes Patients in Indonesia

Most studies indicate that digital health contributes positively to diabetes management, particularly in blood glucose monitoring, patient education, and the improvement of self-management. A study by Fithriana et al. (2025) showed significant differences in blood glucose levels before and after the use of a diabetes monitoring application in Indonesia, namely mySugr. The average initial fasting blood glucose level was 207.35 mg/dL, while after using the application, the average decreased to 188.8 mg/dL. Therefore, it can be concluded that the use of the self-management application (mySugr) is effective in helping patients with type 2 diabetes mellitus monitor their blood glucose levels. This effectiveness was influenced by several factors, such as improved lifestyle monitoring through the application, easy access to routine health records, and the convenience of conducting health consultations.

Digital health is implemented in various forms, including mobile health (mHealth), telehealth, diabetes self-management applications, wearable devices, electronic health records (EHRs), and machine learning–based systems. As explained in a study on an mHealth intervention in Vietnam conducted by Nguyen et al. (2023), the use of mobile health applications was found to increase patient engagement in diabetes management. Patients became more active in monitoring their blood glucose levels, understanding their health conditions, and making behavioral changes, such as improving dietary habits and increasing physical activity. In this context, digital health functions as a form of health communication that supports the development of self-management behaviors among people with diabetes.

The use of digital health also provides benefits for healthcare professionals in conducting remote patient monitoring. Through digital applications, healthcare providers can obtain patients' health data in real time, enabling faster and more personalized evaluation and decision-making processes. However, the implementation of digital health among diabetes patients still faces several challenges. Some of the barriers identified include low digital literacy among patients, limited internet access, insufficient understanding of how to use health applications, and low long-term user engagement with digital platforms. Furthermore, many health applications in Indonesia still primarily focus on basic monitoring and educational functions and, therefore, are not yet fully capable of supporting more complex healthcare decision-making processes (Bilqis, 2023; Irawan et al., 2025).

Communication in Digital Health Systems for Diabetes Patients

The results of the systematic review of 10 research articles revealed that communication within the use of digital health not only functions as a medium for delivering health-related information but has also evolved into an integral part of the technological system itself. Within digital health systems, communication operates through mechanisms such as health data collection, information processing, algorithmic interpretation, and the delivery of health feedback, either automatically or manually. Based on research by Kerr et al. (2024), smartphone-based applications used by patients are considered efficient communication media for delivering health education, supporting independent health monitoring, and providing digital coaching to patients. The study also covered various eHealth platforms that enable two-way communication between patients and healthcare systems through digital applications. Furthermore, the study explained that interactive digital coaching, in which patients input data and the system responds with personalized recommendations, resulted in more significant improvements in HbA1c levels compared with one-way communication systems. This two-way communication pattern aligns with the theory of Computer-Mediated Communication (CMC), which argues that digital technology is not merely a tool for delivering messages and information but also shapes interaction patterns, social relationships, user behavior, and decision-making processes. Health applications can therefore be understood as digital communication ecosystems that create new forms of relationships between patients and healthcare professionals. These interactions are influenced by factors such as accessibility, trust, privacy, and the capability of digital systems to facilitate interactions between users and healthcare providers (Permana et al., 2025).

In another study, German et al. (2024) developed an interactive visualization tool to understand and monitor health disparities in diabetes care. The study did not merely focus on the technology itself but also examined how health data can be communicated to audiences with diverse backgrounds and levels of understanding. The visualization tool played an important role in making complex health data more accessible to various audiences, including nontechnical users such as care managers, nurses, and operational staff. This interactive visualization tool would also be highly relevant if implemented in Indonesia, where disparities in diabetes care remain significant. Several regions and communities in Indonesia still face shortages of healthcare workers, inadequate healthcare facilities, and limited diabetes education (Mulyanto et al., 2023). Therefore, such digital platforms could become powerful communication tools for health policy by visualizing which populations remain underserved socially and geographically by the healthcare system. From a communication perspective, this represents a form of health data communication that bridges the gap between website-based health data and healthcare decision-making processes.

Communication in digital health can be understood as a core technological system that not only delivers information but also performs functions related to monitoring, data interpretation, behavior formation, and support for patient health decision-making. Digital health has transformed the way communication occurs between patients and healthcare professionals. Digital technology no longer functions merely as a communication channel but rather as an active medium that shapes, filters, and even produces health communication content through algorithmic systems.

Communication Models as Technology in Digital Health

Based on the results of the systematic literature review of 10 research articles, it was found that communication in digital health has evolved into an integral part of healthcare technology systems that operate interactively, continuously, and in a data-driven manner. Research conducted by Nguyen et al. (2023) regarding an mHealth intervention for Vietnamese people living with diabetes demonstrated that mobile health applications enable continuous health communication between patients and digital systems. Through these applications, patients can record blood glucose levels, receive health education, obtain medication reminders, and gain digital self-management support. Communication therefore occurs not only between humans but also between patients and digital systems that actively respond to users' health data.

Similar findings were reported in a study conducted by Wilson-Anumudu et al. (2021) and Alnahdi et al. (2025), which showed that digitally based diabetes education systems were able to increase patient engagement in disease management. The program operated through interactive communication processes such as health monitoring, automated feedback, digital education, and continuous behavioral support delivered through digital platforms. Research conducted by Brands et al. (2022) further demonstrated that the use of electronic health records (EHRs) enables communication processes to become more integrated between patients and healthcare professionals. Patients' health data can be accessed more quickly and in real time, thereby supporting the evaluation of health conditions and clinical decision-making processes. In this model, communication operates through digital data integration that connects various actors within the healthcare system. Several health applications and websites are also capable of continuously collecting patients' health data, which are then processed using machine learning technologies to generate interpretations of patients' health conditions. Subsequently, the applications provide automated health feedback to users. Data visualization systems, such as those developed in the study by German et al. (2024), are also considered effective in presenting complex health information in a more understandable manner for various users, including nontechnical healthcare workers and policymakers.

The findings from these studies indicate that the communication model within digital health consists of several main stages, namely:

1) Collection of patient health data through digital applications and wearable devices.
2) Data processing using digital systems, machine learning, and algorithms.
3) Delivery of automated and personalized health feedback.
4) Continuous interaction among patients, digital systems, and healthcare professionals.
5) Formation of self-management behaviors among diabetes patients.

This model demonstrates that communication within digital health functions as a core technological system that performs health monitoring, data interpretation, patient education, behavior formation, and support for healthcare decision-making in a real-time and continuous manner.

In Indonesia, this digital health communication model has significant potential to help overcome limitations in healthcare access, particularly in regions with inadequate healthcare facilities and shortages of healthcare professionals. However, its implementation still requires improvements in digital literacy, technological infrastructure readiness, and the development of digital communication systems that are more adaptive to the needs of diabetes patients in Indonesia.

CONCLUSION

Based on the findings of this systematic literature review, digital health has demonstrated significant potential in supporting diabetes management through various technologies, such as mobile health (mHealth), telehealth, diabetes self-management applications, wearable devices, electronic health records (EHRs), and machine learning–based systems. The reviewed studies indicate that digital health contributes positively to blood glucose monitoring, patient education, self-management, and communication between patients and healthcare professionals. The findings also reveal that communication within digital health has evolved beyond its traditional role as a medium for delivering health information. Communication now functions as an integral part of the technological system itself through processes such as health data collection, digital information processing, algorithmic interpretation, automated feedback, and interactive communication between patients and digital systems. In this context, communication operates as a core technological system that supports health monitoring, behavior formation, and healthcare decision-making processes. Overall, the evidence supports viewing communication as a functional component of digital health rather than merely as a channel for message delivery.

Digital communication has been shown to support self-management behaviors among people with diabetes by increasing patient engagement, self-awareness, treatment adherence, and the ability to monitor health conditions independently. Features such as real-time feedback, digital coaching, reminders, and personalized health information encourage patients to become more active in managing their disease. In Indonesia, digital health has strong potential to address unequal access to healthcare services caused by geographical challenges and the uneven distribution of healthcare professionals. However, the implementation of digital health in Indonesia still faces several challenges, including limited digital literacy, unequal internet access, technological infrastructure limitations, and concerns regarding data privacy and long-term user engagement. The success of digital health implementation in diabetes management depends not only on technological advancement but also on the effectiveness of communication systems in facilitating interactive, accessible, and sustainable health communication for patients. For Indonesia, the practical implication is that digital health programs should integrate the design of feedback, health literacy support, data interpretation, and clinician–patient interaction with the development of technical infrastructure. Because the synthesis included only 10 articles, the proposed communication-as-technology model remains conceptual and should be evaluated through primary empirical research.

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AUTHOR CONTRIBUTION STATEMENT

Anita Permata Sari was responsible for the conceptualization, study design, literature search, data collection, data analysis, interpretation of findings, and manuscript preparation. The author conducted the systematic literature review process, synthesized the findings, developed the communication-as-technology model, and critically revised the manuscript. The author has read and approved the final version of the manuscript and is accountable for all aspects of the research.

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