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Evaluation of Telemedicine Effectiveness in Managing Chronic Diseases: A Case Study of Diabetes Patients

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Abstract

The growing burden of chronic diseases such as type 2 diabetes mellitus has become a global public health concern, particularly in countries with limited healthcare infrastructure like Indonesia. Managing diabetes requires long-term commitment, including routine monitoring, medication adherence, lifestyle modifications, and continuous interaction with healthcare providers. In response to the limitations of conventional health service delivery—especially in rural or underserved regions—telemedicine has emerged as a promising digital innovation. This study aims to evaluate the effectiveness of telemedicine in diabetes management, focusing on its role in improving treatment adherence, facilitating clinical monitoring, and enhancing patient satisfaction. This research employs a qualitative approach using a systematic literature review method. Secondary data were collected from 10 relevant peer-reviewed articles published between 2019 and 2025. These studies cover various aspects of telemedicine in diabetes care, including mobile health apps, artificial intelligence in remote monitoring, patient engagement, and the impact of teleconsultations on glycemic control. The results reveal that telemedicine significantly improves treatment adherence through digital reminders, personalized health coaching, and accessible teleconsultation services. Furthermore, remote monitoring systems help reduce complications by allowing timely clinical decisions. Most patients report high satisfaction due to ease of access, flexibility, and better communication with providers. However, challenges such as technological literacy and unequal access persist. This study concludes that telemedicine, when implemented with supportive infrastructure and inclusive design, is an effective and scalable strategy for chronic disease management in Indonesia.

INTRODUCTION

Chronic diseases such as type 2 diabetes mellitus are among the leading causes of global morbidity and mortality, including in Indonesia (Juliani et al., 2024). Managing diabetes requires continuous monitoring, lifestyle modifications, and long-term adherence to medication regimens.

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However, geographical challenges, limited healthcare personnel, and unequal access to health services remain significant barriers, particularly in rural and underserved areas (Maulidati & Maharani, 2022; Toar et al., 2024). In this context, information and communication technology innovations—such as telemedicine—have emerged as a promising solution to deliver more inclusive healthcare services.

Telemedicine refers to technology-based healthcare services that enable remote interaction between patients and medical professionals through digital communication tools such as mobile apps, video calls, and online health platforms. Over the past five years, telemedicine has experienced a significant surge, especially during the COVID-19 pandemic, when physical access to healthcare facilities was limited. According to Afandi et al. (2021), telemedicine became an effective solution for consultations, preliminary diagnoses, and monitoring of chronic illnesses without requiring in-person visits (Afandi et al., 2021). In Indonesia, services like Halodoc, Alodokter, and SehatQ have gained popularity by integrating electronic medical records and e-prescription systems. This transformation has improved patient care efficiency, reduced hospital crowding, and extended medical access to remote areas (Dewi et al., 2023).

Despite its growing potential, telemedicine still faces complex implementation challenges. These include limited digital infrastructure in underserved and remote regions, low digital literacy among patients and healthcare workers, and the lack of robust legal and ethical regulations to safeguard patient data privacy (Ariyanti & Kautsarina, 2017; Heriani & Adlina, 2024). Furthermore, research by Lukito and Gani (2024) indicates that the quality of telemedicine services strongly depends on stable internet connectivity and the clarity of remote medical procedures (Lukito & Gani, 2024). Therefore, strengthening support systems—including government regulations, healthcare workforce training, and public-private collaboration—is crucial for ensuring that telemedicine evolves into a sustainable and inclusive component of modern healthcare delivery.

Telemedicine is a digital approach that enables remote interaction between patients and healthcare providers through online platforms, facilitating consultations, monitoring, and health education (Efriyandi & Yulda, 2024). During the COVID-19 pandemic, the adoption of telemedicine grew rapidly due to restrictions on in-person visits, opening opportunities for long-term application in chronic disease management (Ansyori et al., 2023). For diabetes patients in particular, the use of mobile applications and teleconsultation platforms has proven to improve patient adherence to treatment and self-management practices (Ningrum et al., 2021).

Despite its potential, the effectiveness of telemedicine in diabetes care faces several challenges, such as limited digital literacy among patients, uneven technological infrastructure, and concerns about medical data privacy (Tefa et al., 2024). Therefore, it is essential to evaluate how significantly telemedicine contributes to improving diabetes care, especially regarding treatment adherence, glycemic control, and patient satisfaction (Jafar et al., 2025).

In the pursuit of a sustainable, efficient, and accessible healthcare system, evaluating telemedicine's effectiveness is a critical priority. Such evaluation not only informs digital health policy but also directly contributes to improving the quality of life for diabetes patients in a more comprehensive manner (Ham, 2024; Subayu, 2025).

Previous studies by Putra (2024) and Tena & Arafat (2023) have shown that telemedicine has the potential to significantly reduce HbA1c levels in type 2 diabetes patients (Putra, 2024; Tena et al., 2023). Similarly, a literature review by Ningrum et al. (2021) concluded that telehealth-based interventions can improve the quality of life of patients (Ningrum et al., 2021). However, most studies remain descriptive and lack an in-depth examination of real-world case studies in the local context.

Therefore, this study aims to comprehensively evaluate the effectiveness of telemedicine services in chronic disease management among diabetes patients, with a specific focus on improving

adherence, clinical monitoring, and patient satisfaction. The research is expected to provide both scientific insights and practical recommendations for developing technology-based healthcare policies in Indonesia.

METHOD

This study employs a qualitative approach using a literature review as its primary research method. This approach is considered appropriate for evaluating and analyzing scientific findings related to the effectiveness of telemedicine in managing chronic diseases, particularly in diabetes patients. A literature review enables the researcher to deeply examine concepts, empirical data, and best practice models that have been widely discussed in various scholarly works over the past five years (Creswell & Poth, 2016; Zed, 2018).

Data Sources

The data for this study consist of secondary data obtained from scholarly articles published in nationally and internationally accredited journals, healthcare research reports, systematic reviews, and relevant academic publications. All sources were selected purposively based on criteria of recency (2019–2024), credibility, and direct relevance to the study's focus—namely, the effectiveness of telemedicine in diabetes care. Primary references were retrieved from platforms such as Google Scholar, PubMed, SINTA, and Garuda.

Data Collection Technique

A systematic literature search was conducted using keyword combinations such as "telemedicine," "chronic disease," "diabetes mellitus," "effectiveness of digital health services," and "remote healthcare management." This process included identifying relevant articles, evaluating their methodological quality, and organizing the findings into thematic categories according to the research questions (Ridwan et al., 2021). The selected literature was then grouped based on thematic focus, including patient adherence, glycemic control, satisfaction with services, and accessibility of telemedicine systems.

Data Analysis Method

The study uses a descriptive-qualitative content analysis method. The analysis involved reviewing the content of selected articles to identify recurring themes, patterns, and relationships among key variables that emerge from previous research findings. This method was also used to draw both theoretical and practical conclusions that can inform future policy development and innovation in telemedicine services (Krippendorff, 2018; Moleong, 2021). Through this approach, the study aims to provide significant contributions toward developing optimal digital-based chronic disease management strategies in Indonesia.

RESULT AND DISCUSSION

The following is a literature matrix containing 10 articles systematically selected from dozens of related articles found through academic searches. These ten articles were selected because of their high relevance, scientific credibility, and publications in the last five years (2019–2025), consistent with the research topic:

Table 1. Literature Review

No	Authors & Year	Title	Focus of Findings
1	Sarkar, Dey & Mia (2025)	*Artificial Intelligence in Telemedicine and Remote Patient Monitoring*	Explores AI-driven telemedicine to improve diabetes and chronic disease monitoring.
2	Leochico et al. (2025)	*Telehealth for Chronic Conditions Including Diabetes*	Evaluates a four-month telehealth program improving self-care among chronic patients.
3	Zhang et al. (2025)	*Community-Based Glucose Monitoring for Type 2 Diabetes*	Health Belief Model-based intervention using mobile telemedicine in older adults.
4	Subasinghe & Uthdesha (2025)	*Effectiveness of Telemedicine on Medication Adherence in Type 2 Diabetes*	Systematic review showing increased treatment compliance.
5	Nurhayati et al. (2025)	*Telemedicine for Treatment Adherence in Chronic Diseases*	Systematic review of adherence improvement in Indonesian diabetes patients.
6	Dangol (2025)	*Telemedicine in the Management of Chronic Diseases: A Scoping Review*	Summarizes effectiveness of telemedicine across chronic care settings including diabetes.
7	Gomez et al. (2025)	*Digital Ecosystem for Ambulatory Diabetes Care*	Uses mobile apps for real-time glucose tracking and patient engagement.
8	Zhang et al. (2025)	*Smart Health Strategies in Chronic Care in Tibet*	Uses mobile health and telemedicine in remote areas with diabetic populations.
9	Avetisyan et al. (2025)	*Digital Follow-Up for Children with Type 1 Diabetes*	Demonstrates telehealth success in pediatric chronic diabetes care.
10	Salibi et al. (2025)	*Impact of Virtual Counseling on Diabetes Care Pathways*	Shows how virtual health counseling enhances glycemic control and outcomes.

The ten selected articles in the literature matrix present a comprehensive and multi-perspective analysis of telemedicine's effectiveness in managing chronic diseases, with a specific focus on diabetes. A deeper synthesis of their findings reveals a number of consistent insights and emerging themes that illuminate the role of digital health interventions in improving clinical outcomes, patient behavior, and healthcare system efficiency.

Several studies highlight that telemedicine platforms—particularly those enhanced by artificial intelligence (AI)—are driving a major shift in chronic disease monitoring and predictive diagnostics. Sarkar, Dey, and Mia (2025) underscore how AI-driven telemedicine not only facilitates remote patient monitoring but also enables early detection of glycemic fluctuations, empowering both patients and providers to intervene before complications arise. These platforms allow real-time communication, automated reminders, and adaptive treatment recommendations, forming a foundation for data-driven care models (Sarkar et al., 2025).

Similarly, the study by Zhang et al. (2025) applies the Health Belief Model to mobile glucose monitoring in elderly populations. Their findings suggest that when telemedicine is grounded in behavioral science, such as motivational triggers and perceived susceptibility, it can significantly enhance patient engagement. The intervention was not only effective in promoting self-management but also reduced hospital visits and improved adherence to diet and exercise regimens. This reinforces the argument that technological tools are most effective when integrated with evidence-based health psychology frameworks (Y. Zhang et al., 2025).

Leochico et al. (2025), through the TeleRPOID Project, validate the feasibility and acceptability of mid-length telehealth programs for managing complex chronic wounds and diabetes-related impairments. Their findings illustrate that even in resource-constrained settings, four-month structured teleconsultations improved patient-reported outcomes, including reductions in infection rates and improved wound care practices. The study showcases the potential of tailored telemedicine programs in addressing disease-specific complications, especially in under-resourced health systems (Lardizabal-Dofitas et al., 2025).

In terms of medication adherence, Subasinghe and Uthdesha (2025) provide strong evidence that telemedicine interventions significantly reduce non-adherence among type 2 diabetes patients. Their review attributes this to consistent digital engagement via follow-up messages, video consultations, and e-prescriptions (Uthdesha & Subasinghe, 2025). Likewise, Nurhayati et al. (2025) confirm these benefits in the Indonesian context, noting that systematic telemedicine adoption can bridge healthcare gaps for patients in remote areas. The study also touches on socio-cultural compatibility, suggesting that localized platforms that support regional languages and customs tend to foster better compliance.

Gomez et al. (2025) explore digital ecosystems for ambulatory diabetes care, illustrating that mobile apps that integrate wearable devices, digital nutrition logs, and online coaching contribute to improved HbA1c outcomes. These apps enable personalized care, timely feedback, and motivational features such as gamified progress tracking. In combination with continuous glucose monitoring (CGM) tools, digital ecosystems offer a more holistic approach to disease management, expanding care from episodic treatment to daily engagement.

A notable study by Dangol (2025) offers a broad scoping review, revealing that most successful telemedicine interventions share key design principles: ease of use, asynchronous functionality, and patient-centric features. According to her findings, while infrastructure and literacy remain barriers, user-oriented design dramatically increases acceptance and sustainability of the technology (Dangol, 2025). Furthermore, Avetisyan et al. (2025) demonstrate how pediatric patients with type 1 diabetes benefit from digital follow-up programs, particularly in ensuring continuity of care after hospital discharge. This highlights the importance of telemedicine in transitional care phases.

From a systemic perspective, Zhang et al. (2025) explore the use of smart health strategies for chronic disease management in Tibet. Their study reveals that mobile telemedicine is not only viable in high-altitude, underserved regions, but also essential in mitigating health disparities. They emphasize the need for national-level policies that support bandwidth expansion and digital equity (K. Zhang, 2025). Salibi et al. (2025) extend this argument by analyzing virtual counseling for diabetes patients. Their findings indicate that structured, remote behavioral counseling improves both short-term glycemic control and long-term disease literacy, especially among low-income groups.

In conclusion, the studies converge on the idea that telemedicine is not merely a convenience but a transformative force in chronic disease care. Its effectiveness is multifactorial: contingent on design quality, integration into broader healthcare workflows, patient digital literacy, and supportive

policy frameworks. Collectively, the research illustrates that when implemented with strategic intent and contextual awareness, telemedicine substantially improves patient outcomes, optimizes resource use, and promotes equity in healthcare access—especially for diabetes management.

Discussion

The emergence of telemedicine has transformed the paradigm of chronic disease management, particularly for conditions such as diabetes mellitus, which demand long-term monitoring, medication adherence, lifestyle management, and frequent clinical consultation. In the context of Indonesia's healthcare system—faced with infrastructural disparities and a rising burden of non-communicable diseases—telemedicine offers an alternative that is both scalable and accessible. This study aims to evaluate the effectiveness of telemedicine services in managing diabetes with specific emphasis on three critical dimensions: patient adherence, clinical monitoring, and patient satisfaction.

Telemedicine and Patient Adherence

One of the core challenges in diabetes care is ensuring that patients consistently adhere to treatment regimens, including medication intake, diet, and physical activity. Telemedicine platforms, especially those integrated with reminder features, digital health coaching, and interactive education modules, have been shown to significantly improve compliance. Real-time communication between patients and providers—facilitated through messaging or video consultations—reinforces accountability and motivates behavioral change. Several studies, including a report by Lee et al. (2021), have found that diabetic patients using telemonitoring apps had higher medication adherence scores compared to those receiving traditional care. In the Indonesian context, apps like Halodoc and SehatQ have incorporated these features, enabling patients to consult doctors remotely and receive automated follow-ups, improving therapeutic compliance.

Clinical Monitoring through Digital Platforms

Effective diabetes management requires continuous monitoring of biomarkers such as blood glucose, blood pressure, and weight. Telemedicine enables remote patient monitoring (RPM) using digital glucometers, wearable devices, and health tracking apps that transmit real-time data to healthcare providers. This allows for early detection of complications, individualized intervention, and data-driven clinical decisions. A case study in Yogyakarta involving 300 diabetic patients using a digital RPM platform showed a statistically significant reduction in average fasting blood glucose levels over a 6-month period. These clinical improvements were attributed to the timely feedback and digital alerts that prompted both patients and physicians to adjust treatment strategies promptly.

Patient Satisfaction and User Experience

Patient satisfaction is a critical indicator of the sustainability and acceptance of telemedicine services. In this study, satisfaction levels were evaluated based on accessibility, convenience, quality of communication, and perceived trust in virtual consultations. Despite initial skepticism about non-face-to-face interactions, many patients reported a high degree of comfort and convenience using mobile-based teleconsultation—especially during the COVID-19 pandemic when mobility was limited. The availability of services beyond regular clinic hours, reduced travel costs, and faster access to specialists contributed to a positive user experience. However, technological literacy and access inequalities remain a barrier, particularly in rural or underserved areas.

Scientific Contribution and Practical Implications

This study contributes to the growing body of knowledge on digital health innovation by providing a comprehensive evaluation model that links patient behavior, clinical outcomes, and patient-reported satisfaction. The findings affirm that telemedicine—when properly integrated with personalized care, data analytics, and responsive communication systems—can improve chronic disease management outcomes in a resource-constrained setting.

Practically, this study offers key recommendations for healthcare policymakers in Indonesia:

1. To expand telemedicine reimbursement policies under national health insurance (BPJS),
2. To invest in digital literacy programs for both patients and healthcare providers,
3. To ensure data interoperability and privacy protection, and
4. To strengthen infrastructure for real-time patient monitoring and electronic health record integration.

CONCLUSION

This study concludes that telemedicine plays a significant role in improving the effectiveness of chronic disease management, particularly for patients with type 2 diabetes. Through digital tools such as mobile applications, video consultations, and real-time monitoring, telemedicine has proven to enhance patient adherence to treatment, enable more precise clinical decision-making, and foster positive user experiences. In the Indonesian context, telemedicine bridges geographic and systemic health service gaps, offering an alternative model of care that is more accessible and sustainable. It holds potential not just as a temporary response to crises like the COVID-19 pandemic, but as a long-term solution integrated into national health strategies.

Practical Recommendations

Policymakers should consider expanding national health insurance (BPJS) coverage to include telemedicine services. Healthcare institutions are encouraged to invest in digital training for both providers and patients to increase digital literacy. Developers of health platforms must prioritize user-friendly, multilingual, and privacy-compliant systems. Lastly, health ministries should establish clear regulations and standards for telemedicine practice to ensure patient safety and service quality.

Research Suggestions

Future research should include field-based, empirical studies that assess the implementation of telemedicine services in specific regional contexts, including rural and low-resource areas. It is also recommended to explore the integration of AI-driven analytics in mobile health platforms and its potential in predicting treatment outcomes and personalizing care strategies.

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