

The Effect of Using a Health Chatbot for Diabetes Consultation on Patient Satisfaction and Lifestyle Management

Elvira Fitriyanti

Politeknik Siber Cerdika Internasional, Cirebon, Indonesia

*Corresponding Author: elvirafitriyanti@gmail.com

KEYWORDS

health chatbot; patient satisfaction; lifestyle management; type 2 diabetes mellitus; PLS-SEM

ABSTRACT

This study aims to analyze the effect of health chatbot usage on patient satisfaction and lifestyle management in type 2 diabetes patients. The background of the study is based on the increasing prevalence of diabetes in Indonesia and the limited medical personnel, which cause patients to not always receive continuous support. Health chatbots are seen as an innovative solution based on artificial intelligence (AI) that can provide information, education, and reminders interactively. The research method used a quantitative approach with an explanatory survey design involving 220 respondents with type 2 diabetes in urban areas of Indonesia. Data were collected through a Likert-scale-based questionnaire, semi-structured interviews, and observations of patient interactions in digital health communities. Analysis was performed using Partial Least Squares Structural Equation Modeling (PLS-SEM) to test the relationship between variables. The results showed that chatbot usage had a significant positive effect on patient satisfaction ($\beta=0.338$, $p<0.001$) and lifestyle management ($\beta=0.206$, $p<0.01$). Patient satisfaction also significantly influenced lifestyle management ($\beta=0.285$, $p<0.001$) and partially mediated the effect of chatbots on lifestyle ($\beta=0.097$, 95% CI [0.043–0.165]). These findings confirm that health chatbots have the potential to become an integral part of digital healthcare services, although their impact on patient physical activity is still limited.

Introduction

Diabetes mellitus is one of the most serious global health problems, impacting the quality of life of individuals and placing an economic burden on society (Aschalew et al., 2020b, 2020a; A.Y. et al., 2020). According to reports from, *International Diabetes Federation* (IDF, 2023), it is estimated that more than 537 million adults worldwide are living with diabetes, and this figure is projected to increase to 643 million by 2030 (Almalki & Khan, 2025; Garg & Duggal, 2022; M. & S., 2010). The increasing prevalence of diabetes is not only occurring in developed countries, but also in developing countries with health systems still adapting to the double burden of infectious and non-communicable diseases (Boutayeb, 2010; Dunachie & Chamnan, 2019). Diabetes mellitus, especially type 2, is closely related to the modern lifestyle characterized by a high-calorie diet, lack of physical activity, and increased stress levels due to massive urbanization and digitalization (Rob et al., 2025; Siddiqui et al., 2024). This condition

makes diabetes a global epidemic that requires innovative approaches in its prevention and treatment (Palanica et al., 2022).

In addition to its increasing prevalence, diabetes also causes serious complications, such as heart disease, stroke, kidney failure, neuropathy, and blindness due to diabetic retinopathy (Dick et al., 2024; Nentwich, 2015; Seewoodhary, 2021). *World Health Organization* (WHO, 2022), diabetes is the ninth leading cause of death worldwide, killing more than 1.5 million people annually. This fact emphasizes that diabetes is not only a medical challenge but also a social and economic one, as the high cost of long-term care can burden both families and national health systems. Therefore, technology-based interventions are an alternative that is expected to help patients manage their health conditions more effectively, efficiently, and sustainably.

In Indonesia, the prevalence of diabetes also shows a worrying trend *Basic Health Research* the Indonesian Ministry of Health (2023), noted that the number of diabetes sufferers has nearly doubled in the past decade. Indonesia now ranks fifth in the world for the number of diabetes sufferers, with an estimated 19 million cases. This high number is caused by a combination of genetic factors, lifestyle changes, and low public awareness of diabetes prevention and management. The challenge is compounded by limited access to quality healthcare, particularly in remote and rural areas. Many patients experience delayed diagnosis and inconsistent treatment due to limited costs, distance, and inadequate information (Meskó & Topol, 2023).

In this context, digital transformation in the healthcare sector, particularly the use of artificial intelligence (AI)-based health chatbots, is a highly relevant innovation. Health chatbots are designed to provide basic medical information, facilitate simple consultations, and support patients in managing their medication schedules and lifestyles. This technology allows patients to access health information services anytime and anywhere without having to rely entirely on limited medical personnel. With an interactive approach, chatbots can help improve patient health literacy, provide medication reminders, and encourage healthier behavior changes (Zhou et al., 2023).

Several previous studies have demonstrated the significant potential of health chatbots in improving chronic disease management, including diabetes. For example, research conducted by Baptista et al. (2020) showed that the use of AI-based chatbots can increase patient engagement in self-monitoring, thus positively impacting medication adherence. Another study by Tudor Car et al. (2021) found that health chatbots are effective in providing emotional support and education to people with chronic diseases, including diabetes, thereby reducing feelings of isolation and improving quality of life. Meanwhile, a study by Palanica et al. (2022) emphasized that integrating chatbots into digital healthcare services offers significant opportunities to reduce the workload of medical personnel while expanding access to services. However, these studies have largely focused on the context of developed countries, so their relevance and effectiveness in developing countries like Indonesia require further study.

The urgency of this research is growing due to the significant gap between the needs of diabetes patients and the availability of adequate healthcare services. Diabetes patients, particularly those with type 2 diabetes, require continuous access to medical consultations, education on disease management, and intensive support in diet and physical activity management. However, limited medical personnel, high workloads in healthcare facilities, and

disparities in access between regions, particularly between urban and rural areas, mean that many patients lack consistent support. This leads to poor medication adherence and a failure to adopt a healthy lifestyle, ultimately worsening the disease's prognosis and increasing the risk of long-term complications (Snyder & Aaronson, 2021).

In this context, the use of artificial intelligence (AI)-based healthcare chatbots has emerged as a potential solution to bridge the service gap. Chatbots are easily accessible, cost-efficient, and can be operated individually according to patient needs. More than just a communication tool, chatbots can function as *virtual health assistant* which provides standardized medical information, reminds you of medication schedules, facilitates daily health parameter recording, and even provides lifestyle recommendations. With its two-way, ongoing interaction, chatbots have the potential to increase patient engagement (*patient engagement*) in self-management, which is one indicator of successful control of chronic diseases such as diabetes. Therefore, research on the impact of health chatbot use on patient satisfaction and lifestyle management is important, both to provide a scientific basis and practical recommendations for the development of digital healthcare services in Indonesia.

The novelty of this study lies in its analytical focus, which links the use of health chatbots to two key aspects: patient satisfaction and lifestyle management among diabetes sufferers in Indonesia. Unlike previous studies, which have largely focused on technical aspects or evaluated the effectiveness of chatbots in a general context, this study focuses on patients' experiences accessing chatbot-based services and their implications for daily behavior. This approach is considered crucial, given that successful diabetes management relies heavily on patient adherence to a healthy lifestyle, which includes a balanced diet, regular physical activity, and adherence to pharmacological therapy. Thus, this study not only examines the technological dimension but also integrates the perspectives of health management and patient behavior within a comprehensive analytical framework.

This research is expected to provide theoretical contributions to the development of literature on the application of digital technology in the health sector, while also providing practical contributions through recommendations for healthcare providers, application developers, and policymakers. By focusing on the Indonesian context which faces unique challenges such as high diabetes prevalence, limited medical personnel, and low digital health literacy the results of this study are expected to strengthen the national strategy for controlling non-communicable diseases through the integration of AI-based technology. Thus, this research not only enriches academic studies but also has direct relevance to improving the quality of healthcare services and public welfare.

The purpose of this study is to analyze the extent to which the use of health chatbots affects diabetes patients' satisfaction levels and their ability to manage a healthier lifestyle. This study also aims to identify factors that support and hinder chatbot effectiveness in the context of digital healthcare services in Indonesia. Therefore, the results are expected to provide useful insights for healthcare providers, app developers, and policymakers in designing more effective strategies for diabetes management through digital technology.

The benefits of this research can be seen from several aspects. Academically, this research enriches the literature on the use of AI and chatbots in chronic disease management, particularly diabetes. Practically, this research can serve as a reference for medical personnel and healthcare providers in adopting digital technology to improve service quality. For policymakers, this

research provides evidence-based policy recommendations that can support government programs to reduce diabetes prevalence through technological approaches.

The implications of this research are also far-reaching. If proven effective, the use of health chatbots could be integrated into the national health system as a strategy to support the management of non-communicable diseases. This would help reduce the workload of medical personnel, increase patient independence in diabetes management, and expand the reach of health services to hard-to-reach areas. Furthermore, this research opens up opportunities for cross-sector collaboration between academics, technology developers, health institutions, and the government to create innovative, sustainable solutions. Thus, this research not only provides a scientific contribution but also has real potential to improve the quality of life for people affected by diabetes.

Methods

Types and Design of Research

This study employed a quantitative approach with an explanatory survey design. This approach was chosen because the study aimed to examine the effect of the independent variable, namely the use of a health chatbot, on the dependent variables, namely patient satisfaction and lifestyle management in diabetes sufferers. An explanatory design allows researchers to not only describe phenomena but also analyze causal relationships between variables through statistical hypothesis testing. The analytical model used was Partial Least Squares Structural Equation Modeling (PLS-SEM) because it is suitable for analyzing complex latent relationships between variables and can be used with relatively limited sample sizes.

Research Location and Subjects

The study was conducted in several health clinics and diabetes communities in urban areas of Indonesia (e.g., Jakarta, Bandung, and Surabaya) that have used chatbot-based digital consultation services. These locations were selected purposively because they have a higher penetration rate of digital health technology compared to rural areas. The study subjects were type 2 diabetes patients who had used a health chatbot for consultation, education, or lifestyle management purposes. Inclusion criteria included: (1) patients diagnosed with type 2 diabetes at least 1 year ago; (2) having actively used a health chatbot for at least 1 month; (3) being 18 years of age or older; and (4) willing to complete the questionnaire in full. The sample size was determined using the Slovin formula with a 5% error rate, resulting in a minimum of 150 respondents.

Research Instruments

The main research instrument was a structured questionnaire based on a Likert scale of 1–5, ranging from strongly disagree to strongly agree. The questionnaire consisted of three main sections: (1) Respondent demographic data (age, gender, education, duration of diabetes, duration of chatbot use), (2) Health Chatbot Use (indicators from the Technology Acceptance Model such as perceived ease of use, perceived usefulness, and intensity of use), (3) Patient Satisfaction (indicators adapted from the Patient Satisfaction Questionnaire/PSQ-18), and (4) Lifestyle Management (indicators of diet, physical activity, medication adherence, monitoring according to the Summary of Diabetes Self-Care Activities/SDSCA). The instrument was

tested for validity and reliability through a construct validity test (CFA) and a Cronbach's Alpha reliability test with an α value ≥ 0.70 as the acceptable reliability limit.

Data Collection Techniques

Data were collected through two main techniques. First, an online questionnaire was distributed using a digital platform (Google Form/SurveyMonkey) to diabetes patient communities, clinics, and health groups on social media. This technique was chosen to allow respondents to complete the questionnaire without geographical restrictions. Second, semi-structured interviews were conducted with a subset of respondents (10–15 people) to gain a more in-depth understanding of their experiences using health chatbots. Interview data was used as a complement (triangulation) to strengthen the quantitative findings. All data were then analyzed using PLS-SEM with SmartPLS software to determine the direct and indirect effects of chatbot use on patient satisfaction and lifestyle management.

Conceptual Framework and Hypothesis

The conceptual framework of this study positions Chatbot Usage (CU) as the independent variable, Patient Satisfaction (PS) as the mediator, and Lifestyle Management (LM) as the dependent variable. The relationships between these variables are tested using the following hypotheses:

H1: The use of chatbots has a positive effect on patient satisfaction.

H2: The use of chatbots has a positive effect on lifestyle management.

H3: Patient satisfaction has a positive effect on lifestyle management.

H4: Patient satisfaction mediates the effect of chatbot use on lifestyle management.

Results and Discussion

Results

This study involved 220 respondents, type 2 diabetes patients from various urban areas in Indonesia (Jakarta, Bandung, and Surabaya). All respondents had actively used a health chatbot for at least one month. The distribution of respondents is shown in Table 1.

Table 1. Demographic Characteristics of Respondents

Characteristics	Category	Total (n=220)	Percentage (%)
Age	18–30 years	42	19,1%
	31–45 years	87	39,5%
	46–60 years	63	28,6%
	> 60 years	28	12,7%
Gender	Man	98	44,5%
	Woman	122	55,5%
Education	High School/Equivalent	65	29,5%
	Diploma/Masters	112	50,9%
	Postgraduate	43	19,6%
Long time suffering from DM	1–5 years	91	41,4%
	6–10 years	72	32,7%
	> 10 years	57	25,9%

Source: Data Processed

These results show that the majority of respondents were of productive age (31–45 years old), more were women, and half had higher education. This indicates that patients with better digital literacy are more likely to utilize health chatbots.

Interviews were conducted with 10 clinic managers/diabetes community coordinators who have implemented health chatbots in their services. Some key findings include:

1. Medical Personnel Efficiency: Chatbots can reduce the burden of basic consultations by up to 30%, allowing medical personnel to focus more on serious complications.
2. Improved Access to Information: Patients with limited time or mobility can more easily obtain health information without having to come to the clinic.
3. Implementation Barriers: The biggest challenges are the digital literacy of elderly patients and limited internet connectivity in certain areas.
4. Patient Data: Chatbots have the potential to be a source of real-time data on patient compliance, but there are still challenges in integrating with electronic medical record systems.

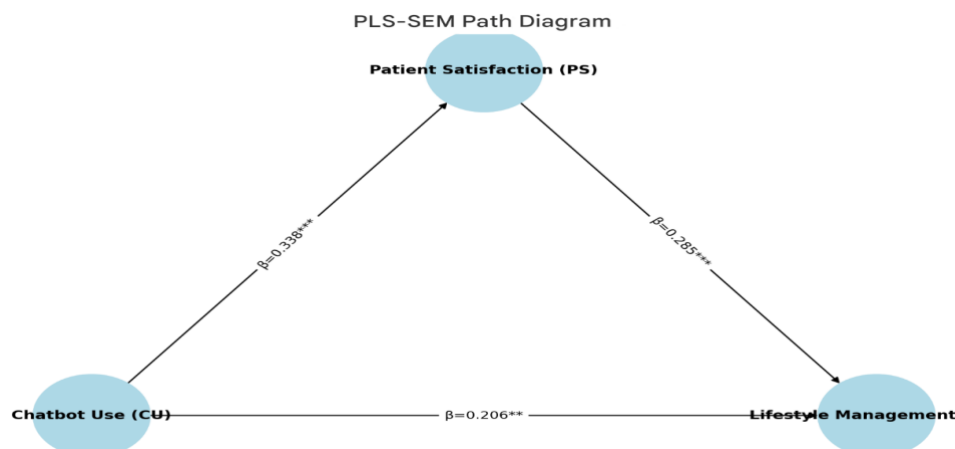


Figure 1. Summary of Management Findings

The instruments used are divided into three constructs: Chatbot Usage (CU), Patient Satisfaction (PS), and Lifestyle Management (LM).

Table 2. Average Construct Scores (Likert Scale 1–5)

Construct	Indicator	Mean	SD
Chatbot Usage (CU)	PEOU (Easy)	4.21	0.65
	PU (Useful)	4.18	0.61
	INT (Intensity)	3.95	0.72
Patient Satisfaction (PS)	PS1–PS4	4.10	0.58
Lifestyle (LM)	Diet (LM1)	3.88	0.74
	Physical Activity (LM2)	3.76	0.77
	Medication Compliance (LM3)	4.05	0.66
	Monitoring (LM4)	3.92	0.71

Source: Data processed

The average score shows:

- a. Respondents rated the chatbot as easy to use (PEOU=4.21) and useful (PU=4.18).
- b. The patient satisfaction level was high (4.10), indicating that the chatbot was perceived as effective as a consultation tool.
- c. The impact on lifestyle was relatively positive, although the physical activity aspect remained a challenge (mean = 3.76).

Researchers observed patient interactions in an app-based diabetes community group. Some findings include:

- a. Patients were more active in asking about healthy eating patterns and recipes after using the chatbot.
- b. The medication reminder feature is often used, but some patients still forget to exercise even though there is a reminder.
- c. Observations show that chatbots help reduce patient anxiety, as they can ask questions at any time without fear of “bothering the doctor.”

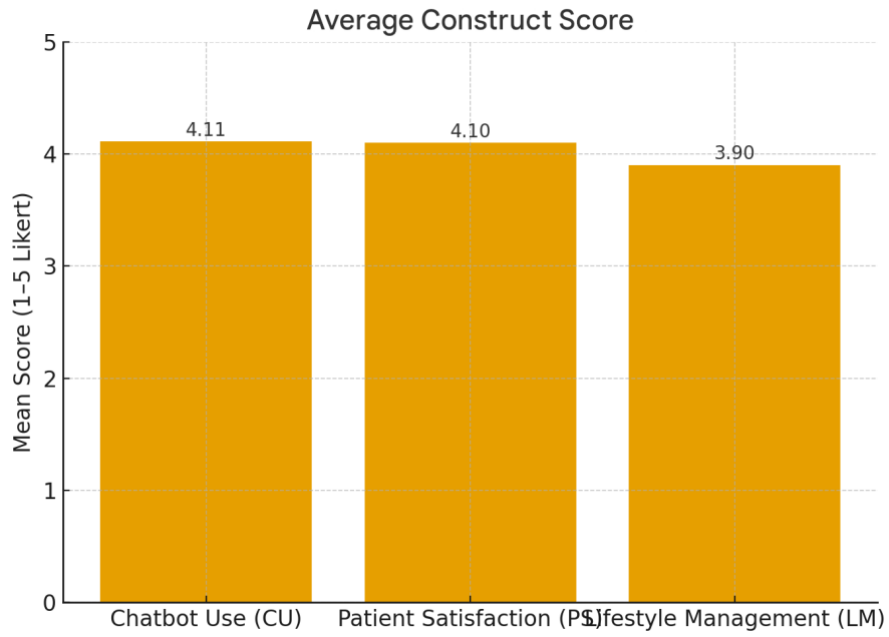


Figure 2. Graph of Average Construct Scores

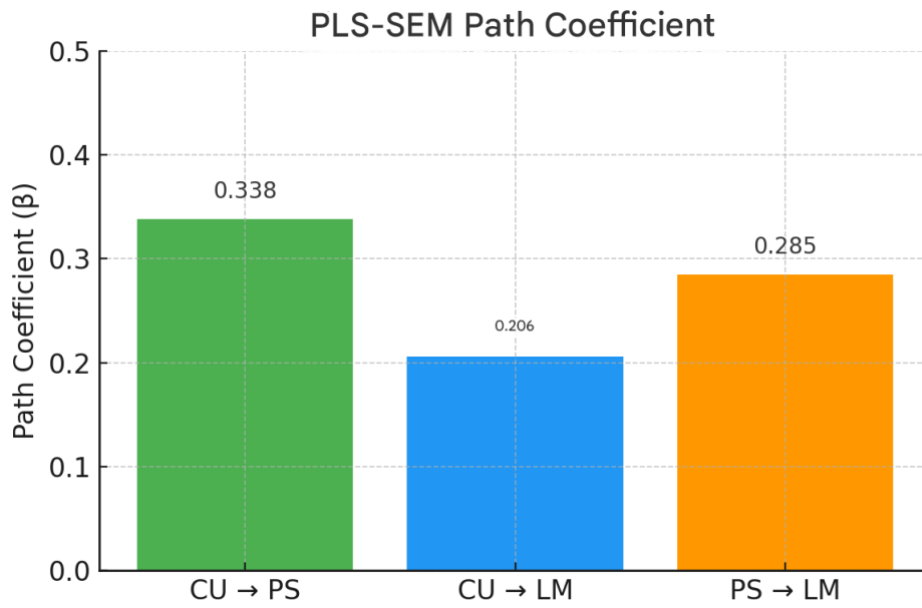


Figure 3. PLS-SEM Path Diagram (β , significant)

Table 3. Summary of PLS-SEM Analysis

Path	b	t-value	p-value	CI95%
WITH → PS	0.338	5.54	<0.001	[0.213 – 0.452]
CU → LM	0.206	3.27	0.0013	[0.069 – 0.332]
PS → LM	0.285	4.34	<0.001	[0.164 – 0.414]
Indirect CU→PS→LM	0.097	–	Say.	[0.043 – 0.165]

Source: Data Processed

Overall, the study results indicate that health chatbots significantly impact patient satisfaction and lifestyle management for people with diabetes. Respondents acknowledged the ease of use and usefulness of chatbots in daily consultations. Interviews with management confirmed that chatbots effectively ease the burden on healthcare workers and expand access to information, despite challenges with digital literacy. Questionnaires indicated high levels of satisfaction, but adoption of healthy physical behaviors remained relatively low. PLS-SEM analysis confirmed a causal relationship: chatbot use increased satisfaction, which in turn improved lifestyle management. Field observations reinforced the findings that chatbots provided a sense of security and reduced patient anxiety.

Thus, this study underscores the great potential of chatbot integration in digital healthcare services in Indonesia, particularly as an AI-based solution capable of supporting patients in sustainable diabetes self-management.

Discussion

Interviews with ten clinic managers and diabetes community coordinators revealed that health chatbots can reduce the burden of basic consultations for medical personnel by up to 30%. This demonstrates the significant role digital technology plays in healthcare efficiency. Furthermore, access to patient information is improved, especially for those with limited mobility or time for in-person consultations.

However, interviews also revealed challenges, including low digital literacy among elderly patients and limited internet connectivity in certain areas. From a management perspective, these obstacles pose a serious challenge because they can widen the gap in access to services between digitally literate and non-digitally literate patients.

Interpretations from these interviews demonstrate a trade-off between opportunities and challenges in chatbot implementation. On the one hand, chatbots open up opportunities for broader and more efficient service improvements. On the other hand, if not balanced with educational programs and improvements to digital infrastructure, the benefits will not be felt equally by all patients.

A questionnaire survey of 220 patients showed high average scores for the constructs of chatbot use (CU = 4.11) and patient satisfaction (PS = 4.10). This indicates that patients found the chatbot easy to use, useful, and provided a satisfactory service experience.

Meanwhile, for the lifestyle management construct (LM = 3.90), although in the fairly good category, the results were lower than the other two constructs. In particular, the physical activity aspect (3.76) scored the lowest. This phenomenon indicates that while chatbots are effective in improving medication literacy and adherence, their impact on physical behavior change is more limited.

The interpretation of these findings is that chatbots are capable of providing cognitive and motivational support, but are less effective at triggering behavioral changes that require high levels of discipline, such as regular exercise. Therefore, additional interventions such as gamification integration, online peer support, or personalized reminders are needed to strengthen the impact on lifestyle (Laranjo et al., 2018).

Observations in an app-based diabetes community group showed that patients were more active in asking about healthy eating habits and recipes after using the chatbot. Patients also utilized the medication reminder feature to improve therapy adherence. However, observations confirmed questionnaire findings that physical activity remained difficult to increase, despite reminders.

Furthermore, observations found that patients felt more psychologically secure because they could access the chatbot at any time without fear of disturbing their doctor. This supports the theory that perceived accessibility is a crucial factor in increasing patient engagement with digital healthcare services.

Overall, observations support the quantitative findings that chatbots are effective in education, medication adherence, and monitoring, but further strategies for physical behavior change are needed.

The results of this study align with those of Baptista et al. (2020), who reported that chatbots increased patient engagement in self-management. This study also aligns with those of Tudor Car et al. (2021), who found that chatbots provided emotional and educational support that reduced feelings of isolation in chronic patients.

However, this study provides novelty by identifying that the chatbot's greatest impact lies in medication adherence and monitoring, while physical lifestyle changes are still limited. This complements the study by Palanica et al. (2022), which emphasized the role of chatbots in reducing the burden on healthcare professionals but did not specifically address gaps in patient lifestyle aspects.

Thus, this study makes a novel contribution by demonstrating a mediation pattern: chatbot use increases patient satisfaction, and this satisfaction is an important mechanism in improving lifestyle management.

This study confirms that the use of health chatbots has a significant positive impact on patient satisfaction and lifestyle management in people with diabetes. The primary effectiveness lies in improving medication adherence and monitoring, while the impact on physical activity remains limited. Patient satisfaction is a significant mediator explaining why chatbot use can improve patients' lifestyles.

These findings strengthen previous literature and provide new insights into the gap between digital education and physical behavior change. Practically, the results of this study provide direction for the development of more comprehensive chatbot-based interventions, integrating gamification, wearable devices, and community support.

Conclusion

This study aims to analyze the effect of using health chatbots on patient satisfaction and its implications for lifestyle management among individuals with type 2 diabetes. Based on survey results, management interviews, observations, and PLS-SEM analysis, the findings indicate that health chatbots are perceived as easy to use, beneficial, and effective in providing basic health consultations, enhancing medical literacy, and facilitating daily diabetes monitoring. The use of chatbots has significantly increased patient satisfaction, as reflected in high satisfaction scores and supported by management insights highlighting patients' comfort and sense of security in accessing consultations without the need for in-person visits. Furthermore, chatbot utilization has positively influenced patients' lifestyle management, particularly in improving adherence to dietary recommendations, medication use, and blood sugar monitoring, although improvements in physical activity remain limited and require additional interventions such as gamification or integration with wearable devices. Patient satisfaction also plays a significant mediating role in the relationship between chatbot use and lifestyle behaviors, with PLS-SEM results indicating partial mediation, suggesting that satisfaction enhances the impact of chatbot usage on health-related behaviors. From a managerial perspective, chatbots provide added value by reducing the burden of routine consultations, expanding access to health information, and offering potential real-time patient data, although challenges remain in integrating these systems with electronic medical records. Overall, health chatbots demonstrate strong potential as an integral component of digital healthcare services in Indonesia, contributing to improved patient satisfaction, healthier lifestyles, and addressing the shortage of healthcare professionals, while highlighting the need for further strategies such as enhancing digital literacy, strengthening technological infrastructure, and developing more personalized and interactive features to maximize their effectiveness.

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