Indonesian Nurses' Perspectives on Developing Mobile Applications to Improve Diabetes Management in the Community: A Qualitative Study

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Abstract: Many diabetes patients in Indonesia face challenges adhering to treatment plans, highlighting the urgent need for technology to support effective community-based diabetes care. This technology can help patients manage their condition better, improve treatment adherence, and reduce the risk of complications. This study explored nurses' perspectives on developing mobile applications for diabetes using a qualitative descriptive design with seven nurses from a public health center in Magelang, Indonesia. Focus group discussions, observational forms, and audio recordings were used to capture detailed data, with each discussion lasting 50 minutes and conducted at the public health center. The semi-structured questions were conducted from May 2022 to December 2023, focusing on the challenges of providing diabetes care and developing a mobile application. The study highlighted four themes: complaints about diabetes care, need for technology diabetes care, challenges of patients, and challenges of family.

The study's findings underscore several key implications for nursing practice, particularly in enhancing diabetes care through mobile technology. Nurses can use these applications to provide continuous patient education, improve treatment adherence, and monitor patients more effectively. Mobile tools also support patients and their families, addressing challenges in managing diabetes outside of clinical settings. Finally, nurses can advocate for integrating such technology into healthcare policies, contributing to better community-based diabetes management.

Keywords: Community nursing, Diabetes management, Digital technology, Mobile Application, Remote area

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Introduction

Diabetes and its complications are a primary cause of morbidity and mortality globally, contributing significantly to the healthcare burden.[1] Numerous patients with diabetes in Indonesia face significant challenges in adhering to treatment. For example, often forgetting to take their medications or monitor their blood glucose levels regularly, which can lead to the deterioration of their health over time.[2] Barriers to diabetes care are caused by a lack of access to healthcare resources, limited understanding of diabetes management, and cultural barriers that may affect patients' willingness to engage with their treatment regimens.[3] To address these challenges effectively, it is crucial to develop innovative technology tailored to support diabetes care in community settings. A study in Singapore explored a diabetes care app, but its functionality was limited to medication reminders and lacked support for overall diabetes management.[4] A qualitative study in the Netherlands explored perspectives on diabetes care apps but did not develop a new app to address the limitations of existing ones.[5] However, no studies have explored the nurse's perspective for developing a comprehensive diabetes care application in Indonesia. While patients are indeed the primary users of mobile applications in healthcare, understanding nurses' perspectives is equally crucial, as they play a vital role in the integration and effectiveness of these tools. Nurses have unique insights into patient needs, workflows, and the practical challenges of implementing technology in clinical settings. Their feedback can inform mobile applications' design, usability, and functionality, ensuring that they meet patient expectations and enhance nurses' ability to deliver care effectively. Additionally, educational platforms integrated within these applications can offer resources on diabetes management.[6] Mobile applications can be a significant component of mHealth, focusing solely on apps limits the examination of integrated solutions, such as remote monitoring, telemedicine, and health data analytics, that collectively address public health challenges, promote preventive care, and foster a more holistic approach to health management.

Review of Literature

The prevalence of diabetes in the Indonesian community was 9.19% in 2020, affecting approximately 18.69 million people, and is projected to increase to 16.09% by 2045, which would represent about 40.7 million individuals.[7] The incidence of diabetes will increase due to the increasing number of people categorized as high-risk populations, such as a history of other diseases, age, overweight, lack of physical activity, ethnicity, and race.[8] Also, living in rural areas can raise the risk of diabetes due to limited access to healthcare and unhealthy lifestyle choices.[9] In Indonesia, delivering nursing care for patients with diabetes living in rural areas presents unique challenges. One of the primary difficulties is the limited access to healthcare facilities, which are often far from rural communities, making regular check-ups and monitoring inconvenient and sometimes impossible. This geographical barrier can hinder nurses from providing consistent education and support, as patients may struggle to travel long distances for appointments.[10] Additionally, a shortage of trained healthcare professionals often leads to a lack of specialized diabetes care.[11] Furthermore, nurses may face challenges in educating patients about the complexities of diabetes management, mainly when patients have limited health literacy.[12] Cultural beliefs can complicate care, as patients may prefer traditional medicine or resist lifestyle changes due to misconceptions about diabetes.[13]

Consequently, nurses must use innovative strategies (e.g., mHealth) to empower patients and improve diabetes care. Since mobile phone technology provides several options, it has gained widespread acceptability across various populations.[8] mHealth, or mobile health, refers to using mobile devices and applications to support public health and clinical practice, particularly in managing chronic diseases such as diabetes and non-communicable diseases (NCDs).[14] In diabetes care, mHealth applications facilitate glucose monitoring, medication adherence, dietary tracking, and patient education, empowering individuals to manage their condition more effectively.[15]

The benefits of mobile applications for diabetes management include improved patient engagement, real-time health monitoring, personalized feedback, and enhanced communication with healthcare providers.[15] However, challenges such as data privacy concerns, varying levels of digital literacy among patients, and the need for integration with existing healthcare systems can hinder these tools' widespread adoption and effectiveness.

Short message service (SMS), text messaging, smartphone applications (apps), and wearable technologies are typical mHealth modalities. In addition, the expanding field of mobile health (mHealth) has been implemented in several areas for health promotion, behavior change assistance, and diabetes self-management. In Indonesia, the use of medical digital technology for diabetes management is still in its early stages, with limited adoption in many regions. Although some urban areas have apps for monitoring blood glucose, medication reminders, and virtual consultations, these tools are not widely available or integrated into public health systems.[16] Many patients depend on traditional healthcare services but face challenges like limited access to digital tools, low technological literacy, and unreliable internet connectivity.[17] Additionally, awareness about the benefits of digital health solutions for diabetes care remains low, and more efforts are needed to ensure broader access and utilization across the country.

Multiple studies on diabetes care technology have been conducted to address challenges in delivering care. For example, a qualitative study found strong support from practitioners, patients, and families for a digital solution to improve diabetes care, with their challenges and suggestions shaping the Diabetes Compass design in Tanzania and Sri Lanka.[18] Another qualitative study in Malaysia explored patients' perspectives, revealing positive views on the benefits of telemedicine in diabetes care.[19] A study in South Memphis, USA, documented that smartphone apps may be a feasible, low-cost resource for patients with limited access to traditional healthcare.[20]

Initial studies demonstrated the potential value of mHealth in diabetes care improvement. The field continuously expands, and the parameters of existing evidence-based interventions are heterogeneous. Moreover, the studies above mentioned that a vast array of mHealth technologies with various characteristics are available to patients with diabetes globally. However, the research fails to examine the need to develop mobile diabetes care, particularly in Magelang, Indonesia. Magelang, a small city, faces significant challenges in managing diabetes care due to limited access to advanced technology. Many patients with diabetes often struggle to adhere to their treatment plans, which can lead to complications and worsening health outcomes. Additionally, nurses frequently report being overwhelmed by the workload associated with managing diabetes care, as they lack sufficient tools to monitor and support their patients effectively. Given these challenges, there is growing hope that a thorough assessment of the need for technological solutions in diabetes care will help address these issues. Developing a mobile diabetes care service in Indonesia is crucial because the country has a scarcity of licensed diabetes specialists, resulting in a shortage of nurses to deliver diabetes education care.[21] The methods by which nurses require mobile diabetes care for treatment optimization at public health centers in Indonesia are not well documented. Understanding the development process could help nurses deliver diabetes care that is more efficient, innovative, and culturally sensitive. For this reason, the research question is: Why are mobile applications necessary to improve diabetes management in community health services in Indonesia?

Study aim

This study aimed to explore nurses' perspectives on developing mobile applications to improve diabetes management in community health services in Magelang, Indonesia.

Method

Design: Due to the complexity and context-specific nature of healthcare practices, a qualitative descriptive study design was chosen. Furthermore, qualitative research allows for an in-depth understanding of the clinical nurse's perspective and detailed insights that quantitative methods may overlook.[22] This approach is particularly valuable in a culturally diverse setting like Indonesia, where regional practices, language barriers, and differing access to technology can influence healthcare delivery. The study adhered to the Consolidated Criteria for Reporting Qualitative Studies (COREQ).

Participation and Setting: The research was conducted in the public health center of Magelang, Indonesia, from May 2022 to December 2023. This facility is located in a rural area with limited access to advanced technology. When faced with patients who have difficult and complex healthcare conditions, they refer them to higher-level hospitals for further treatment. The participants were seven clinical nurses working in that public health center. The participants were registered nurses who: 1) worked in the field of diabetes care, 2) joined PROLANIS (Program Pengelolaan Penyakit Kronis), 3) had experience in diabetes care for more than a decade (> 10 years), 4) had graduated with at least a diploma and/or bachelor's degree in nursing. Joining the PROLANIS program offers numerous benefits for patients with diabetes. Through PROLANIS, participants gain access to personalized monitoring and management plans, which can lead to improved blood glucose control and overall health outcomes. The program emphasizes regular health check-ups, education about diabetes, lifestyle modifications, and tools necessary for self-care. Furthermore, through interaction with healthcare professionals and support groups, participants can foster a sense of community, reducing feelings of isolation often experienced by those managing chronic conditions.

Ethical Consideration: The study commenced after approval (0XX/KEPK-FIKES/II.3.AU/F/2024) was obtained from the Ethics Committee of the Faculty of Health Science, Universitas Muhammadiyah Magelang, Indonesia. Before the study began, participants were briefed on the study purpose, rights, potential benefits, the voluntary nature of their involvement, and the assurance of confidentiality before signing the consent form. Before each interview, the researchers scheduled a face-to-face meeting with participants to introduce themselves, explain the goals of both the interview and the research, and clarify participants' rights—particularly their right to decline participation or withdraw from the study at any point.

Data Collection: The data collection process began by explaining the research purpose to participants, obtaining signed consent forms, providing information in simple language, requesting permission to gather data, and ensuring the confidentiality of their information. Focus group discussions (FGDs), observational forms, and audio recordings were used to capture detailed data. FGDs lasting 50 minutes each were conducted at the public health center. The researchers explained the study's objectives and its potential impact on diabetes technology development to the head of the PROLANIS division. The head then identified two participants, and five additional participants were recruited through the snowball sampling method. The study included only seven nurses due to a shortage of human resources in the research setting, which could be considered a limitation of the study.

The researchers conducted two sessions of FGDs for six months, from May to October 2022, beginning with two participants recruited with the assistance of the head division of PROLANIS. The second session of FGD was continued from November 2022 to June 2023, involving five participants. The study was conducted over an extended period (two sessions) due to participants' busy schedules and Muslim holidays, which delayed data collection. FGDs continued until data saturation was achieved. The two FGDs provided rich qualitative data, even with limited participants (two in one session and five in the other). Each session was designed to facilitate in-depth discussion and reflection, allowing

participants to express their perspectives and experiences fully. During the analysis of the FGDs, the researchers noticed that the same themes and insights began to emerge consistently across both sessions. This repetition suggested that the researchers were nearing a point of data saturation, where no new significant information was being generated.

The demographic form consists of age, gender, education level, work experience, job position, and working unit. The questions primarily focused on challenges in delivering diabetes care and the need to develop a mobile application: 1) What difficulties are commonly encountered in diabetes management services? 2) How is technology used in diabetes management services at community health centers? 3) What challenges do patients and families face when using technology? 4) Have there been cases where patients forget their medication, leading to clinical complaints? 5) What is your perspective on developing a mobile application to improve diabetes care in public health centers? The researcher continued to ask more thorough questions to obtain an appropriate description based on the participants› responses. All participants were asked the same basic questions, but each had unique conversation topics based on the need to develop a mobile application for diabetes care.

To ensure the effectiveness of the qualitative study approach, the authors underwent rigorous training that included comprehensive workshops on qualitative research methodologies, ethical considerations, and data collection techniques. This training encompassed practical exercises in conducting interviews and focus groups and instruction on coding and analyzing qualitative data. Additionally, the authors were guided in developing reflexivity skills to enhance their awareness of personal biases and perspectives, ultimately equipping them with the necessary tools to gather rich, nuanced qualitative data that accurately reflects participants′ experiences and insights.

Data Analysis: Demographic data were analyzed to capture the participants' characteristics. The researchers employed thematic analysis for the qualitative data outlined by Miles and Huberman.[23] Initially, interviews were transcribed verbatim shortly after each session, and the transcripts were read multiple times for thorough understanding. Field notes and artifacts were incorporated to enhance the data during the analysis process. Next, initial coding was conducted during the preliminary analysis of the transcripts. These codes were then clustered to create preliminary subthemes, refined through further analysis until distinct themes emerged. The analyzed and interpreted data were sent back to all participants to assess the interpretation made by the researchers and for them to suggest changes if they were unhappy with it or because they had been misreported. Data saturation was reached with the seventh participant since the data presented redundancy, and the researchers achieved findings representative of the phenomena. The transcripts of the interviews were read multiple times, connected with the purposes of the study. Words, sentences, or paragraphs similar in subject matter and context were grouped and assigned codes. The codes that contained related ideas were separated into their independent categories.

Rigor and trustworthiness: The rigor and trustworthiness of this study were ensured by considering several key criteria[24] as follows: First, credibility and dependability were utilized to establish trustworthiness and confirm the quality of the study, with credibility assessed through researchers checking and triangulation of various data from participants. Dependability was evaluated using peer debriefing methods, which involves a process where researchers engage with peers to discuss, clarify, and critique their research processes, decisions, and interpretations. Credibility was achieved when the conceptual descriptions were accepted as valid by individuals who had successfully implemented change and qualitative research professionals. Second, extensive description and appropriate contextual information regarding the setting, sampling technique, and sample characteristics proved transferability. Third, a verification process was used to ensure confirmability, including the research advisory team double-checking the transcriptions, the results of the ongoing data analysis, and the study process.

Findings

Characteristics of the study participants are summarized in **Table 1.** The participants were predominantly female, and the age ranged from 30 to 50 years. Most participants had a diploma, possessed over ten years of work experience in the diabetes area, and worked as nurse practitioners or educators. During the data collection process, the researchers presented four themes that emerged from the nurse's perspective on the need for developing mobile applications to improve diabetes management in community health services (**Table 2**): *Complaints about diabetes care, the need for technology diabetes care, challenges of patients, and challenges of family.*

Table 1. Characteristics of participants

No. ID	Sex	Age (years)	Education in nursing	Experiences (years)	Role	Working area	Targeted patients
N1	Male	30	Diploma	12	Nurse practitioner	Community nursing	Type 2 diabetes in rural area
N2	Female	45	Bachelor	15	Nurse educator	Community nursing	Type 2 diabetes in rural area
N3	Female	38	Diploma	11	Nurse practitioner	Community nursing	Type 2 diabetes in rural area
N4	Female	36	Diploma	14	Nurse practitioner	Community nursing	Type 2 diabetes in rural area
N5	Male	49	Bachelor	20	Nurse educator	Community nursing	Type 2 diabetes in rural area
N6	Female	37	Bachelor	22	Nurse educator	Community nursing	Type 2 diabetes in rural area
N7	Female	40	Diploma	19	Nurse practitioner	Community nursing	Type 2 diabetes in rural area

Table 2. Nurses' perspective on the need for developing mobile applications to improve diabetes

No	Themes	Sub-themes
1	Complaints about diabetes care	1.1 Clinical symptoms
		1.2 Limited access to medications
		1.3 Nonadherence to diabetes treatment
2	Need for technology diabetes care	2.1 Lack of effective diabetes care
		2.2 Geographical barriers to access
3	Challenges of patients	3.1 Need for reminder applications
		3.2 Lack of consultation
4	Challenges of family	4.1 Limited access to patient conditions
		4.2 Lack of communication
		4.3 Socio-cultural concern

Theme 1: Complaints about diabetes care

Sub-theme 1.1: Clinical symptoms

Nurses noted that diabetes-related complaints include challenges in assessing the patient's response to therapy, as well as issues like hypertension and leg pain. During care, a strong emphasis was placed on assessing the clinical symptoms using mobile diabetes care. When mobile technology is utilized, there is the

potential for improved communication between nurses, patients, and caregivers.

> *Patients with diabetes seeking treatment at the public health center may present with various clinical complications. Some people had hypertension, rapid spikes, and drops in their blood glucose levels. Some patients may develop leg discomfort or pain* (N3).

> *They began to experience this after disobeying the counsel given to them by the medical staff at the North Magelang Health Center. People's complaints about drug access also stem from the fact that so many medications are available that they become monotonous to take* (N1).

> *Some clinical concerns include tingling in the feet, losing sensation when walking, high blood pressure, and other issues. I hope mobile technology will help this assessment* (N2).

Sub-theme 1.2: Limited access to medications

Nurses reported that patients have limited access to medications due to a lack of information. This issue particularly affects patients living far from the public health center. Therefore, developing an application to support medication access would be a promising solution to this concern.

> *Most patients reported to have limited access to medication since they are living away from the public health center. Patients do not know which type of diabetes medication to buy when they run out of medication at home* (N6).

Sub-theme 1.3: Nonadherence to diabetes treatment

Nurses highlighted that patients often forget to take their medication, and their families do not know which medications should be taken throughout the day. Nurses also hope that there will be an application.

> *Many patients with diabetes often miss their medication doses because they simply forget to take them. This can happen for various reasons, such as busy schedules or not having a routine in place. It's important for us to find ways to help them remember their medications, like using reminder apps or setting alarms, to remind patients to adhere to their diabetes treatment* (N3).

> *Patients frequently report that they forget to take their diabetes medications, which leads to nonadherence. This forgetfulness can stem from daily distractions or a lack of a structured routine* (N4).

Nurses complained that many patients forgot to adhere to the diabetes treatment. One primary factor is the complexity of their medication regimens, which can involve multiple medications taken at different times throughout the day. This complexity can lead to confusion and forgetfulness, especially if patients do not have a structured routine. Additionally, many patients lead busy lives, juggling work, family responsibilities, and other commitments, which can distract them from remembering their treatment schedules. Emotional factors, such as stress or depression, can also impact their motivation and focus, making it harder to prioritize their health. Furthermore, a lack of support from family or healthcare providers may contribute to this forgetfulness, as patients may not have reminders or encouragement to help them stay on track.

> *Many patients with diabetes often forget to adhere to their treatment plans due to the complexity of their medication schedules. They may have multiple medications to take at different times, which can be overwhelming* (N3).

The lack of a support system in diabetes care significantly hinders patient outcomes and adherence to treatment plans. Nurses often observe that patients who lack family or community support struggle to manage their condition effectively. Additionally, the lack of a structured support system can lead to feelings

of isolation and frustration, which can further diminish motivation to adhere to treatment.

> *Nurses frequently see that patient without a strong support system struggle to manage their diabetes effectively. Without encouragement from family or friends, many forget to take their medications or monitor their blood glucose levels. It's essential for us to advocate for support networks that can help these patients stay motivated and engaged in their care* (N2).

Nurses stated that many patients experience uncontrolled diabetes due to a lack of routine in taking their medication, unhealthy lifestyles, and low motivation about their diabetes treatment.

> *Many patients are struggling with uncontrolled diabetes, often due to inconsistent medication adherence and lifestyle choices. To address this issue, we need to develop technology that can assist patients in managing their condition more effectively* (N7).

Nurses observed that most patients forgot the treatment. Patients feel anxious or guilty about missing their medication or monitoring their blood glucose levels, which can lead to stress and further forgetfulness. Some patients might try to compensate by taking their medication late or doubling up on doses, which can be dangerous. Others may simply ignore the missed treatment and hope it will not have significant consequences, underestimating the importance of consistent management.

> *When patients forget to follow their diabetes treatment, they often express feelings of anxiety or guilt about missing their medication. Some may try to catch up by taking their doses late or doubling up, which can be risky* (N2).

Theme 2: Need for technology diabetes care

Sub-theme 2.1: Lack of effective diabetes care

Nurses explained that the delivery of diabetes care lacks effectiveness due to the technology that supports patients' needs related to treatment. The government, along with health policymakers, is encouraged to take this concern into account to optimize diabetes care.

> *Nurses working in diabetes care often find that the lack of supportive technology hinders our ability to provide effective treatment. Implementing technology could greatly enhance our care by facilitating better communication* (N5).

Sub-theme 2.2: Geographical barriers to access

Geographical barriers to accessing diabetes care pose significant challenges for patients, particularly those in rural or underserved areas. Nurses reported often encounter patients who must travel long distances to reach healthcare facilities, leading to missed appointments and delayed treatment. This lack of accessibility impacts patients' ability to receive regular check-ups and necessary medications and limits their access to educational resources and support services crucial for effective diabetes management.

> *Nurses often see firsthand how geographical barriers severely limit patients' access to diabetes care, especially for those in rural or underserved areas. We believe that implementing telehealth services could be a vital solution to bridge these gaps, allowing patients to receive the care and education they need without the burden of travel* (N1).

Theme 3: Challenges of patients

Sub-theme 3.1: Need for reminder applications

Patients may seek advice from healthcare providers or rely on family members for support, but the cycle of forgetfulness can continue without a structured reminder system. Ultimately, this inconsistency can lead to fluctuations in blood glucose levels, increasing the risk of complications associated with diabetes.

> *It is crucial for us as nurses to educate patients and encourage the use of reminder systems to help them manage their treatment more effectively* (N3).

Sub-theme 3.2: Lack of consultation

The lack of consultation with patients with diabetes can significantly hinder effective disease management and patient outcomes. When healthcare providers do not engage in thorough discussions with patients about their treatment plans and lifestyle modifications, patients may feel uninformed and unsupported in managing their condition. This communication gap can lead to misunderstandings about the importance of regular monitoring, resulting in poor self-management practices.

> *We often notice that a lack of consultation with patients can lead to significant gaps in diabetes management. When we don't take the time to discuss treatment plans and address patient concerns, they may feel confused and unsupported in managing their condition* (N4).

Theme 4: Challenges of family

Sub-theme 4.1: Limited access to patient conditions

Limited access to information about patients' conditions in diabetes care can severely impact the effectiveness of treatment and management strategies. When healthcare providers do not have comprehensive data regarding a patient's blood glucose levels, dietary habits, and lifestyle factors, it becomes challenging to tailor care plans that meet individual needs. This lack of access can stem from various issues, including inadequate communication between patients and providers, insufficient monitoring tools, or gaps in health records.

> *This gap in information can arise from inadequate communication or insufficient monitoring resources, resulting in patients missing out on necessary guidance and support. Improving access to patient data is essential for us to provide tailored care and enhance health outcomes for those living with diabetes* (N7).

Sub-theme 4.2: Lack of communication

The lack of communication with family members in diabetes care can profoundly impact a patient's ability to manage their condition effectively. Family support plays a crucial role in encouraging healthy behaviors. When healthcare providers do not involve family members in discussions about treatment plans and lifestyle modifications, patients may feel isolated and less motivated to follow through with their care.

> *This disconnect can lead to misunderstandings about the importance of diabetes management and reduce the overall effectiveness of treatment. We can create a supportive environment that empowers patients to take control of their health and improve their diabetes management outcomes* (N6).

Sub-theme 4.3: Socio-cultural concern

Cultural beliefs and practices can influence dietary choices, physical activity levels, and attitudes toward medication, all critical factors in diabetes management. For instance, certain cultural traditions may prioritize specific foods that are high in carbohydrates or glucoses, making it challenging for patients to follow dietary recommendations.

> *Social stigma surrounding diabetes can lead to feelings of shame or embarrassment, discouraging individuals from seeking help or discussing their condition openly. Access to healthcare resources may also be affected by socio-economic status, with some patients facing barriers such as transportation issues or lack of insurance. Understanding and addressing these socio-cultural factors is essential for healthcare providers to deliver effective, personalized care that respects patients' backgrounds and promotes better health outcomes* (N5).

Discussion

The study highlighted that the nurses documented the symptoms related to diabetes in the public health center of Magelang Indonesia, including hypertension, unstable blood glucose level and foot pain. Integrating family support was crucial in enhancing medication

adherence and management outcomes for diabetes and hypertension.[25] In addition, nurses are encouraged to utilize clinical and computerized Decision Support Systems (DSS) to enhance the management of patients with diabetes and hypertension at the public health center level.[26] Our study also documented limited access to diabetes medications due to patients living far from the center. Therefore, nurses may employ mobile technology to assess risk factors, as the growing adoption of mobile phones and smartphones provides an excellent opportunity to enhance diabetes care and self-management.[27] Nonadherence to treatment and uncontrolled diabetes were also identified during the data collection process at the center in Magelang. A study highlights the need for concerted, multidimensional efforts and a series of interventions to overcome these barriers, such as patient-tailored medication counseling.[28]

Our investigation explores that diabetes care delivery is ineffective due to a lack of technology to meet patients' treatment demands, remind therapy and support the treatment. Integrating telehealth services can facilitate remote consultations, allowing patients to receive care and support without the need to travel.[29] Additionally, developing and promoting mobile health applications can help patients track their blood glucose levels, medication schedules, and dietary habits, thereby enhancing self-management.[30] Implementing educational initiatives that teach patients how to utilize available technologies for diabetes management can empower them to take charge of their health.[31] Collaborating with technology companies to create tailored solutions for diabetes care can also help meet specific patient needs. Increasing access to continuous glucose monitoring devices can enable patients to manage their condition more effectively.[32] A multidisciplinary team should use telehealth and mobile health to connect with their patients and help with diabetes care.[33]

Our research examines the findings that many patients with diabetes in Magelang often forget their treatment and express a need for an easy-to-use application to remind therapies. The government in Indonesia plays a crucial role in addressing the issues surrounding diabetes management and patient adherence to treatment. First, it can invest in public health initiatives that promote awareness and education about diabetes, emphasizing the importance of medication adherence and self-management.[34] Additionally, the government can ensure that patients receive the necessary consultations and support by establishing policies that improve access to healthcare services, particularly in underserved areas in Magelang.[35] The innovative digital ecosystem for diabetes care has benefits like short visits that are easy to schedule and better documentation in populations with diabetes in Magelang. Furthermore, funding research on diabetes management can lead to better interventions.

The study emphasizes that families face several challenges in supporting their loved ones with diabetes in Magelang. For example, limited access to information about the patient's condition, lack of communication with healthcare providers, and socio-cultural concerns related to diabetes care. When family members don't have enough information about the patient's health, they may find it hard to offer the right support and encouragement for managing the condition.[36] Additionally, insufficient communication between families and healthcare professionals can lead to misunderstandings about treatment plans and the importance of adherence. Socio-cultural factors (e.g. belief) can also further complicate diabetes management within families.[37] These challenges highlight the need for improved communication and education to empower families in their role as caregivers and advocates for patients with diabetes.[38] Nurses can empower families to actively participate in diabetes management, helping them understand the importance of medication adherence and healthy habits. Nurses can help start discussions about cultural issues and encourage families to share their cultural beliefs that may affect care.[39]

Limitations

The study focused on a public health center in Magelang, Indonesia may offer valuable insights; its transferability to other settings would require careful consideration of local contexts to determine if the findings are relevant and applicable. Many places outside Indonesia already have established applications and technologies designed to optimize diabetes care in community services. This existing mobile application may reflect different standards, capabilities, and practices. The study included only seven nurses due to a shortage of human resources in the research setting, which could be considered a study limitation. Thus, while the limited number of participants is a noted limitation, it does not preclude the possibility of reaching saturation, especially if the participants offer diverse backgrounds and can articulate their views comprehensively. This demonstrates that in qualitative research, the depth of information gathered can sometimes outweigh the breadth offered by a larger sample.

Conclusions and Implications for Nursing Practice

As nurses, developing mobile applications for diabetes care can be started by identifying the specific needs of patients to gather insights on features they would find beneficial. Collaborate with software developers to design a user-friendly interface that includes functionalities; ensure that the app has secure data storage and complies with healthcare regulations for patient privacy; include options for patients to share their data with healthcare providers for better management; finally, conduct user testing and seek feedback to refine the application before its launch. Nurses can glean valuable insights from mobile technologies developed in various countries, particularly regarding their application in improving healthcare delivery and patient engagement. For example, mobile health (mHealth) apps utilized in regions with diverse healthcare systems can offer innovative approaches to patient monitoring, medication adherence, and health education. Nurses can identify culturally relevant features that resonate with local populations, ensuring that the mobile solutions align with social norms, languages, and health literacy levels. Also, adapting these technologies to local contexts not only enhances their effectiveness but also fosters greater patient participation in their healthcare journey. Ultimately, integrating lessons learned from global practices can lead to improved health outcomes and more efficient care delivery in a nurse's own country.

When developing diabetes mobile applications for Indonesia, it is important to consider several cultural issues. First, the varying levels of digital literacy among users may affect how easily they can navigate the app. Additionally, local dietary habits and food availability should be considered, as traditional Indonesian foods may impact diabetes management. Religious practices, such as fasting during Ramadan, can also influence health routines and should be considered in the app's recommendations. Furthermore, the strong reliance on family in Indonesian culture means that the app could benefit from features that encourage family involvement in diabetes care. Overall, tailoring the app to respect local customs and health practices will improve user acceptance and effectiveness.

Recommendation for Future Research

Based on these findings, several suggestions may be made to aid in the promotion of constructive approaches to the treatment of diabetes in Magelang. Patients must have excellent health literacy and numeracy levels to successfully self-manage their food, exercise, medication, and insulin doses. In addition, when implementing mobile diabetes care, it is essential to evaluate the patient's level of engagement with technology, educational material, self-care behaviors, and user satisfaction. Mobile diabetes care can help patients stick to their medication,

food, and exercise routines like any other technological health solution. Mobile diabetes care is an effective method for managing diabetes because it allows for regular patient interaction and prompt dissemination of the most recent health condition information. There is a possibility that comprehensive mobile apps will reflect individual and systemic facilitators to achieve better outcomes. Patients with low salaries should not be priced out of receiving mobile diabetes care due to the associated costs.

Many public health institutions do not yet use the program due to a lack of available resources. Even when patients have trouble using their mobile diabetes care, they should keep their routine appointments with their doctors and other health care specialists. Conversations not only about the environment of the home but also about the activities that take place daily can help nurses obtain insight into how to respond correctly to diabetes-related applications. Diabetes specialists in Magelang have the opportunity to take a more proactive part in leading discussions with treatment principals. Finally, there is a need for additional studies to identify the ideal balance between expanding the engagement between patients and nurses and maintaining scalability in Magelang.

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มุมมองของพยาบาลชาวอินโดนีเซียในการพัฒนาแอปพลิเคชันมือถือเพื่อปรับปรุงการจัดการโรคเบาหวานในชุมชน : การศึกษาเชิงคุณภาพ

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บทคัดย่อ: ผู้ป่วยโรคเบาหวานจำนวนมากในอินโดนีเซียเผชิญกับความท้าทายในการปฏิบัติตามแผนการรักษา ซึ่งเน้นถึงความจำเป็นเร่งด่วนในการใช้เทคโนโลยีเพื่อสนับสนุนการดูแลโรคเบาหวานในชุมชนอย่างมีประสิทธิผล เทคโนโลยีนี้สามารถช่วยให้ผู้ป่วยจัดการกับอาการของตนได้ดีขึ้น ปรับปรุงการปฏิบัติตามการรักษา และลดความเสี่ยงของภาวะแทรกซ้อน การศึกษานี้สำรวจมุมมองของพยาบาลในการพัฒนาแอปพลิเคชันมือถือสำหรับโรคเบาหวานโดยใช้การวิจัยพรรณนาเชิงคุณภาพ ในกลุ่มพยาบาล 7 คนจากศูนย์บริการสาธารณสุขในเมืองมาเกลัง ประเทศอินโดนีเซีย การรวบรวมข้อมูลเชิงลึก ใช้วิธีการสนทนากลุ่ม แบบบันทึกการสังเกต และการบันทึกเสียง โดยการสนทนากลุ่มแต่ละครั้งใช้เวลา 50 นาที และดำเนินการที่ศูนย์บริการสาธารณสุข ใช้คำถามกึ่งโครงสร้างในการเก็บข้อมูลตั้งแต่เดือนพฤษภาคม พ.ศ. 2565 ถึงเดือน ธันวาคม พ.ศ. 2566 โดยเน้นประเด็นความท้าทายในการดูแลโรคเบาหวานและการพัฒนาแอปพลิเคชันมือถือ ใน 4 ประเด็น ได้แก่ ปัญหาข้องใจเกี่ยวกับการดูแลโรคเบาหวาน ความต้องการเทคโนโลยีในการดูแลโรคเบาหวาน ความท้าทายของผู้ป่วย และความท้าทายของครอบครัว

ผลการศึกษาชี้ให้เห็นถึงผลกระทบที่สำคัญหลายประการต่อแนวทางการพยาบาล โดยเฉพาะอย่างยิ่งในการปรับปรุงการดูแลโรคเบาหวานผ่านเทคโนโลยีมือถือ พยาบาลสามารถใช้แอปพลิเคชันเหล่านี้เพื่อให้ความรู้ คำแนะนำแก่ผู้ป่วยอย่างต่อเนื่อง ปรับปรุงการปฏิบัติตามการรักษา และติดตามผู้ป่วยได้อย่างมีประสิทธิผลมากขึ้น โทรศัพท์มือถือยังเป็นอุปกรณ์ที่ช่วยเหลือผู้ป่วยและครอบครัวโดยแก้ไขปัญหาในการจัดการโรคเบาหวานนอกสถานที่บริการทางคลินิก ในที่สุด พยาบาลสามารถสนับสนุนการบูรณาการเทคโนโลยีดังกล่าวเข้ากับนโยบายการดูแลสุขภาพ ซึ่งจะช่วยให้การจัดการโรคเบาหวานในชุมชนดีขึ้น

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คำสำคัญ: การพยาบาลชุมชน การจัดการโรคเบาหวาน เทคโนโลยีดิจิทัล แอปพลิเคชันมือถือ พื้นที่ห่างไกล

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