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Research Article

Balancing Need and Feasibility: Stakeholder Insights on Frequent Blood Glucose Monitoring in Indonesia

Agnes Christie Rinda [1,2]

Umi Athiyah [3*]

Andi Hermansyah [3]

[1] Doctoral Program of Pharmaceutical Science, Universitas Airlangga, Surabaya, East Java, Indonesia
[2] Department of Pharmacy, Universitas Sari Mulia, Banjarmasin, South Kalimantan, Indonesia
[3] Department of Pharmacy Practice, Universitas Airlangga, Surabaya, East Java, Indonesia

*email: umi-a@ff.unair.ac.id; phone: +6285750021167

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Abstract

Patients with type 2 diabetes mellitus require regular evaluation of the medication's effectiveness and safety through blood glucose and HbA1c testing. This continuous monitoring is one of the primary roles of pharmacists in collaboration with physicians and supported by health insurance to examine the fluctuation patterns of blood glucose levels in response to diabetes medications. This study aimed to identify the need and feasibility of frequent blood glucose monitoring from the perspective of physicians, pharmacists, national health insurance officials, and diabetes patients. A qualitative study using semi-structured interviews was conducted in six Public Health Centers and seven pharmacies in Banjarmasin, Indonesia, from November 2022 to September 2023. A total of twenty-one respondents were included in this study. Data were tape-recorded, transcribed verbatim, and categorized using manual thematic content analysis. This study reveals that inappropriate patient conditions, irregular visits to Public Health Centers, patients' negative emotions, limitations in self-monitoring blood glucose, and lack of patients' knowledge create barriers to conducting monitoring of diabetes. On the other hand, the frequent blood glucose and HbA1c testing was supported by positive perceptions of the importance of testing, ease of access, and the active roles of physicians, pharmacists, and insurance officials. The barriers and facilitators of continuous diabetes medication monitoring are key factors that pharmacists, physicians, and insurance officials should consider to ensure that medication effectiveness and safety are monitored effectively.

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INTRODUCTION

Diabetes mellitus represents a major global health crisis, driving substantial morbidity and mortality through both microvascular and macrovascular complications[1,2]. Achieving and maintaining optimal glycemic control is essential for mitigating these devastating long-term outcomes, as strong evidence confirms that sustaining near-normoglycemia significantly reduces the incidence and progression of disease-related complications[3]. Therefore, accurate measurement of blood glucose provides crucial information about glucose metabolism, guiding timely interventions necessary for the overall health and survival of patients[1].

Self-Monitoring of Blood Glucose (SMBG) is a vital component of successful diabetes self-management. The American Diabetes Association (ADA) recommends daily SMBG for individuals with type 2 diabetes receiving insulin or oral hypoglycemic agents, with intensive insulin regimens requiring 6 to 10 checks daily[4]. Research correlates a higher testing

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frequency with improved glycemic control. However, practical challenges—such as pain, inconvenience, and the long-term sustainability of frequent monitoring—create significant barriers for patients[5]. In low- and middle-income countries (LMICs) like Indonesia, these issues are compounded by limited availability, affordability, and concerns over the quality assurance of SMBG devices[6], underscoring the urgent need for equitable access initiatives.

In Indonesia, the *Program Pengendalian Penyakit Kronis* (Prolanis), a Chronic Disease Control Program integrated into the national universal health coverage system, aims to standardize the regular monitoring of chronic conditions such as diabetes. This program stipulates monthly evaluations of fasting blood glucose, biannual glycosylated hemoglobin (HbA1c) assessments, and annual comprehensive blood chemistry analyses[7,8]. Despite this national framework, implementation consistency remains poor; one study alarmingly reported that scheduled HbA1c testing was rarely performed, and compliance with monthly fasting glucose monitoring was as low as 3%[9]. Pharmacists, as part of the healthcare team, play a critical role in monitoring the effectiveness and safety of diabetes therapy, yet enhancing their role requires strong collaboration with physicians and supportive policies from the health insurance system to ensure integrated and continuous care[10].

Given the widely acknowledged importance of glucose monitoring, a comprehensive investigation into its prevalence and effects within the complex Indonesian context is crucial. Gathering robust evidence is necessary to inform policy decisions, improve management strategies, and address existing disparities in access, quality, and patient outcomes. Building on this context, the present study aims to identify the specific need for and feasibility of frequent blood glucose monitoring by gathering insights from key stakeholders: physicians, pharmacists, national health insurance officials, and diabetes patients.

MATERIALS AND METHODS

Materials

This research employed a qualitative study design centered on in-depth interviews with key stakeholders, including physicians, pharmacists, diabetes patients, and National Health Insurance program officials. The primary objective was to thoroughly assess the current implementation of the Prolanis and to investigate the practical feasibility and perceived necessity of integrating more frequent blood glucose monitoring into the routine care for enrolled patients. All procedures involving human subjects were conducted with the highest ethical standards, and formal approval for the study was secured from the Ethical Committee of Medical Research at Universitas Lambung Mangkurat on September 5th, 2022 (Reference No. 298KEPK-FKULM/EC/IX/2022).

Methods

Sampling and respondents

Respondents for this study were carefully selected using a purposive sampling strategy to ensure representation across the spectrum of diabetes care and policy within the Indonesian healthcare system. This approach allowed us to target individuals with specific, relevant expertise, experience, and authority. The eligibility criteria for participation were strictly defined and included: Physicians actively involved in the delivery of the Prolanis services; Pharmacists directly providing diabetes care and monitoring; Patients officially enrolled and participating in the Prolanis program; and National Health Insurance officials with direct involvement in the planning or policy implementation of the Prolanis initiative. This ensures that the collected data reflects a comprehensive view from clinical practice, patient experience, and systemic policy.

Data collection

A semi-structured interview guide was meticulously developed to explore the multifaceted perspectives of respondents across three key areas: the necessity and feasibility of frequent blood glucose monitoring (FBGM); current monitoring practices and their implementation within Indonesia's National Health Insurance program; and the opportunities and challenges associated with increasing the frequency of monitoring within the National Health Insurance framework. Before participation, all informants received comprehensive information detailing the study's purpose, methodology, potential risks, and benefits, and subsequently provided written informed consent.

Interviews were systematically conducted by the lead researcher in Banjarmasin, South Kalimantan, spanning the period from November 2022 to September 2023. Sessions took place at times and locations mutually convenient to the interviewer

and the participants. Each interview was audio-recorded and transcribed verbatim to ensure data fidelity. Data collection rigorously continued until thematic saturation was demonstrably achieved, ensuring the completeness and depth of the qualitative findings.

Study reliability

To ensure the credibility and reliability of this qualitative study, several rigorous strategies were implemented. The primary method involved data triangulation, where qualitative insights gathered from various respondent groups—including patients, physicians, pharmacists, and health insurance officials—were systematically compared and cross-referenced with quantitative information extracted from patient medical records and official National Health Insurance guidelines. Furthermore, methodological trustworthiness was enhanced through member checking, which involved validating the accuracy of transcripts and preliminary findings with the original respondents. The research team also conducted regular peer debriefing sessions to critically review the data analysis process and findings. Finally, all key methodological decisions and data interpretation processes were meticulously documented through systematic logs, ensuring a transparent and auditable research trail.

Data analysis

Data analysis was conducted meticulously using thematic analysis. This systematic approach began with the researchers immersing themselves in the content through multiple reviews of the transcripts to gain familiarity and identify potential overarching concepts. Transcripts were then rigorously coded, with the research team employing a consistent methodology to ensure analytical rigor. Emerging concepts were grouped into descriptive themes, and any discrepancies in coding or thematic interpretation were addressed and resolved through thorough discussion during regular team meetings, fostering collaborative consensus. Finally, illustrative quotes were carefully selected to support and exemplify the finalized themes, providing a rich, humanized context and a nuanced understanding of the respondents' perspectives.

RESULTS AND DISCUSSION

The twenty-one respondents included in this study were strategically selected to represent key stakeholders in diabetes management: six physicians, seven pharmacists, three national health insurance officials, and five diabetes patients. To ensure the richness and integrity of the data, all interviews were tape-recorded and subsequently transcribed verbatim. The duration of these in-depth interviews ranged from 26 to 70 minutes. Detailed demographic and professional characteristics for all participants are comprehensively presented in **Table I**.

Table I. Respondent demographics.

Characteristics	Number of respondents
Gender: n (%)	
Male	5 (24)
Female	16 (76)
Age (years old): Average±SD	37.29±11.7
Education: n (%)	
Junior high school	1 (5)
Senior high school	4 (19)
Diploma	3 (14)
Bachelor degree	13 (62)
Occupation: n (%)	
Primary care physician	6 (29)
Pharmacist	7 (33)
Health insurance official	3 (14)
Private worker	3 (14)
Retired	1 (5)
Trader	1 (5)

The qualitative data collected from physicians, pharmacists, health insurance officials, and diabetes patients regarding frequent blood glucose and HbA1c testing were successfully categorized into two major, overarching themes: facilitators and barriers that influence the adoption and adherence to these essential monitoring practices. These themes, which capture

the multi-faceted challenges and supportive elements within the healthcare system, are meticulously summarized in **Table II**. To ensure accuracy and maintain the integrity of the data, direct quotations from all Indonesian-speaking respondents were translated into English verbatim by Sastra Lingua Indonesia, a certified translation agency.

Table II. Barriers and facilitators to performing routine blood glucose and HbA1c testing.

Parameters	Details
Barriers	Inappropriate patients conditions
	Irregular visits of patient to primary health centers (PHCs)
	Patients' negative emotions
	Limitations in self monitoring blood glucose
	Lack of patients' knowledge
Facilitators	Positive perceptions of the importance of blood glucose and HbA1c testing
	Ease of access to blood glucose and HbA1c testing
	Active roles of physician, pharmacist and insurance representative

Barriers to frequent blood glucose and HbA1c testing

Respondents in this study collectively highlighted a significant range of perceived barriers impeding effective blood glucose monitoring among patients. These challenges included the practical difficulty of managing the procedure under inappropriate patient conditions (e.g., severe illness or lack of privacy), coupled with the systemic issue of irregular patient visits to PHCs. Crucially, the process was complicated by patients' negative psychological and emotional responses, such as anxiety, fear of pain, or discouragement from consistently high results. Furthermore, limitations related to SMBG devices (e.g., cost, strip availability, or technical issues) and a pervasive lack of patient knowledge regarding the importance and correct technique of frequent testing were frequently cited as significant obstacles. Collectively, these identified physical, systemic, as well as behavioral barriers underscore the complexity of achieving optimal glycemic control in a real-world setting.

Inappropriate patient conditions

Interviews with respondents revealed that inappropriate patient conditions were the primary factor hindering the regular monitoring of blood glucose and HbA1c levels. A significant barrier identified was the absence of the patient during scheduled appointments, often being represented by family members or caregivers. Furthermore, a common issue was the patient's failure to adhere to the required fasting protocol prior to testing. These logistical and preparation issues directly undermine the validity and feasibility of obtaining accurate, routine glycemic data, complicating effective disease management and emphasizing the need for better patient education and support within the care system.

> **Physician D:** "*Some people have others manage their health check-ups, like a child picking up a prescription or a housekeeper. Because of this, they may not always keep track of their blood sugar levels.*"
> **Patient G:** "*I wasn't fasting before, so they (the physician) just gave me the same insulin medication. Sometimes they check my blood pressure, but they didn't do a blood sugar test back then. If I had been fasting, they probably would have checked that too. Usually, it's done about once every six months.*"
> **Patient S**: "*Actually, it is recommended, sometimes we fast for a long-time ma'am. There are a lot of people at the health center, "it's 9 o'clock and you haven't eaten yet", so we cannot stand it. So, in the end, the fast is too long. Sometimes we are asked, "are you fasting, sir?", oh, I cannot stand it ma'am.*"

Irregular patient visits to PHCs

Irregular patient visits to PHCs pose a significant barrier to the consistent execution of scheduled blood glucose and HbA1c testing. This inconsistency stems from a combination of multifaceted, real-world challenges. Key contributing factors include patients' busy schedules and competing commitments, difficulties with transportation access, insufficient support from caregivers—particularly for elderly patients—and forgetfulness concerning the scheduled testing dates. Furthermore, the surprising ease with which patients can obtain necessary medication without a prescription reduces the perceived urgency of clinical visits, further undermining adherence to the mandated monitoring schedule.

> **Patient HA:** "*I did not check (blood glucose) because I was busy.*"
> **Insurance representative H:** "*The patient might have been busy that day, even though the full examination only took place on that day.*"

Physician J: "*Transportation can be a real hassle for the elderly. A lot of the time, they find themselves waiting for their kids to swing by and pick them up, but with how busy life gets, that doesn't always happen. Sometimes, they even end up visiting their kids and end up missing their health appointments.*"
Physician D: "*Sometimes people come for follow-up visits. Some live far away or need to wait for a family member to take them to the health center.*"
Pharmacist R: "*Many passive patients often hesitate to visit their physicians, opting instead to purchase previously prescribed medications from regular pharmacies. This approach is typically driven by convenience and the desire for affordability, as they may find it easier to obtain the same medicines without the need for a consultation.*"

Patient's negative emotions

While the necessity of monitoring blood glucose and HbA1c levels for evaluating therapeutic response in diabetes is well-established, it is crucial to recognize the psychosocial barriers patients face. A significant number of individuals experience negative emotions associated with this essential diagnostic process, most notably the fear of needles (needle phobia) and the pervasive fear of knowing the results (sometimes termed "diabetic distress"). These psychological factors can severely impact patient compliance, leading to under-testing and suboptimal self-management, which ultimately hinders the attainment of desired glycemic targets.

Pharmacist AU: "*Sometimes there are some who don't check, maybe because they are afraid of needles or whatever, maybe the Public Health Center will only check those who want to.*"
Insurance representative A: ""*But sometimes people are afraid to have their blood tested.*"
Physician G: "*Then there are also those who just want to take the medicine quickly or they are afraid to see the reality of their blood sugar levels, for example, they are fasting, and they become afraid and sometimes afraid of being scolded by the doctor.*"

Limitations in SMBG

While regular blood glucose testing at PHCs is a standard practice, implementing SMBG at home presents significant challenges for patients. A notable finding from the study is that several respondents expressed difficulty in performing SMBG due to the lack of necessary monitoring tools (e.g., glucometers and test strips). This inability to afford or access essential equipment represents a critical barrier to effective self-management. This observation aligns with existing literature indicating that affordability and accessibility of SMBG devices are substantial obstacles, particularly in settings without robust health insurance coverage for such supplies[11].

Even among those who do possess the tools, several reported substantial difficulties rooted in behavioral and motivational factors. Patients frequently described regular home testing as a boring, cumbersome, and demotivating activity, leading to a decline in their sustained adherence to the practice. Furthermore, a critical gap in the care continuum was identified: even among patients who consistently perform SMBG at home, some fail to report their results to their physician. This failure to integrate patient-generated data into clinical decision-making limits the utility of SMBG and compromises the quality of diabetes management.

Patient HA: "*I do not have the glucometer yet to check myself at home.*"
Patient HE: "*I used to have the glucometer, but it was broken, the battery was installed inside for too long.*"
Patient S: "*Yes, I have bought it several times, lately I have been a bit lazy (checking my blood sugar), it takes too long, I am tired of being checked over and over again.*"
Patient S: "*I did not report the results to the physician, so I just wanted to see for myself, to check, "oh it's gone up", sometimes if it has gone up maybe the food needs to be adjusted. Oh, diabetes is difficult, ma'am, it is hard to cure, that is hard, if you do not eat you feel weak.*"

Lack of patients' knowledge

Irregularity in both blood glucose and HbA1c testing, as reported by the study respondents, is significantly attributed to a lack of adequate patient knowledge regarding the importance and proper frequency of these monitoring practices. This critical finding underscores a systemic barrier where deficits in health literacy and specific diabetes education impede adherence to recommended testing schedules. Consequently, this deficiency in patient understanding contributes directly to suboptimal glycemic control and highlights an urgent need for targeted educational interventions within diabetes management programs.

Pharmacist R: "*Maybe sometimes those patients do not know that they actually have a quota to check their HbA1c.*"
Insurance representative R: "*Sometimes patients feel that they are comfortable taking medication regularly, so they feel that it is not necessary or important to have a lab check.*"
Patient HE: "*If it is often at night, you urinate often at night, you're thirsty too, so there's no need to check your blood sugar, we just feel if it is high (sugar level), because it is been a long time since we found out.*"

Facilitators to frequent blood glucose and HbA1c testing

Analysis of the qualitative data revealed several key factors that strongly encouraged respondents to engage in regular blood glucose and HbA1c monitoring. Foremost among these was the positive perception of the tests' clinical importance, where patients recognized monitoring as an indispensable tool for preventing complications and sustaining long-term health. This intrinsic motivation was significantly supported by ease of access to testing resources and, critically, the active and collaborative roles played by healthcare providers. Specifically, physicians, pharmacists, and national health insurance officials were cited as pivotal in reinforcing adherence by educating patients, facilitating testing procedures, and ensuring continuity of care. These findings suggest that adherence to glycemic monitoring is not solely a matter of patient willpower but relies heavily on a supportive, accessible, and well-integrated healthcare system.

Positive perception of the tests' clinical importance

A strong consensus emerged among all respondent groups regarding the importance of specific monitoring metrics. Participants uniformly recognized that both blood glucose testing (SMBG or point-of-care) and HbA1c assessment are essential tools for accurately evaluating and adjusting the effectiveness of diabetes medication and overall therapeutic regimens.

Patient A: "*From that check we know our sugar, if we do not use insulin anymore, our blood will automatically be high. Well, that is the impact later.*"
Physician G: "*Later, he will check his sugar every month, it is certain that if the referral program is carried out, he will check his blood sugar because we will also monitor it, if it is not okay, the dose can be increased. Every 3 months, 3 or 6 months, HbA1c blood chemistry test, so from there we can see, the blood chemistry can show the function of kidney.*"
Physician N: "*Moreover, if you check HbA1c, you can see the compliance of taking medication from there, for example he routinely takes medication or whether the medication is suitable or not, like that. So, for example his HbA1c is high, he says he is taking medication, and it is questionable whether he is really taking the medication, but it is not in accordance with his condition, the medication is not suitable. If for example the case is that his HbA1c is high and he has had therapy, it could be considered for referral to be rearranged what medication or the dosage is increased or not.*"
Pharmacist AU: "*The effectiveness of the medicine is seen from the blood sugar results, if it's diabetes, it is better if there are results. Same as blood pressure, there will be results.*"

Ease of access to testing resources

All participants in this study consistently agreed that the national health insurance system has played a crucial enabling role in diabetes self-management. Specifically, respondents acknowledged that the program facilitates patient access to regular, free blood glucose and HbA1c checks.

Insurance representative R: "*If diabetes, fasting blood glucose must be done every month, every six months, 3-6 months is for HbA1c test... or if for example the HbA1c result is poor, it can be conducted every three months.*"
Physician N: "*This patient is indeed given a monthly diabetes check-up. If we also get a patient who is not taking their medication regularly or has additional complaints, maybe we can check their blood sugar two hours after eating. So, there is a check every six months for hypertension and diabetes patients, after that, for example for diabetes patients, there is a monthly fasting blood glucosetest. If every six months, the HbA1c will be checked.*"
Pharmacist AG: "*What this referral back program means is that he must have his HbA1c checked every six months if I am not mistaken, it is like that in the lab, it is also covered by National Health Insurance, he is required to have a lab check-up. So, we facilitate it, we already have this.*"
Pharmacist AN: "*National Health Insurance covers HbA1c test, but if I'm not mistaken, it is only once every six months, but if it's done routinely, it's good. Every month for blood sugar checks, after six months, for HbA1c, I mean we really monitor it like that.*"

Active role of physician, pharmacist and insurance representative

The strong consensus among respondents regarding the importance and ease of access to diabetes monitoring tests was significantly reinforced by the acknowledged active roles of healthcare professionals and national health insurance officials. Across multiple responses, patients consistently highlighted that encouragement and education from their physicians, pharmacists, and insurance representatives were crucial factors. This finding underscores the human element in successful diabetes management: when all members of the healthcare ecosystem actively promote testing, it not only validates the clinical necessity of monitoring but also translates to greater patient engagement and perceived ease of access, directly supporting adherence to treatment guidelines.

> **Insurance representative R:** *"For the one that is being scheduled, it's already known, so we give a paper, for example on the 24th of next week... on the 24th we check the lab, "Sir/Madam, there is 6-monthly examination schedule". Okay, just bring it, there is already a paper and a schedule."*
>
> **Pharmacist R**: *"Well, that is what we sometimes tell, we say, Ma'am, if you join National Health Insurance, you will get a quota to have your blood drawn here, later you will get a quota every six months, and what is checked is actually HbA1c, that's what we tell the patient."*
>
> **Physician D**: *"It has been informed, "ma'am, you'll check the lab later", on this date, come on this date, come. Then, next month if you want to take the medicine, you do not have to wait until next month. If you want to go to the public health center, just come, so you can just have a check-up. For the visit later, for blood and sugar checks, you have to fast the night before."*

Blood glucose and HbA1c testing are fundamental components of diabetes management, as they provide information on glycemic control. HbA1c reflects the average blood glucose level over the previous three months, offering a long-term control measure, while frequent blood glucose measurements capture short-term fluctuations that may require immediate therapeutic adjustments. Both parameters are crucial for preventing acute and chronic complications, optimizing treatment, and improving the therapy outcomes[4].

Recognizing the importance of frequent monitoring in diabetes management, the American Diabetes Association (ADA) has promoted continuous glucose monitoring (CGM) systems, which provide near real-time glucose readings, reveal patterns and trends, and alert patients and healthcare providers to impending hypoglycemia or hyperglycemia. This approach enhances short-term management while complementing periodic HbA1c testing for a comprehensive assessment of glycemic control[4,12].

Higher frequency of glucose monitoring has been linked to reduced episodes of hypoglycemia and greater glycemic time in range (TIR), which in turn is associated with better HbA1c outcomes. In addition, the analysis of glucose patterns obtained from CGM can identify specific periods requiring therapeutic adjustment—for instance, to prevent hypoglycemia, enhance glycemic control at particular times of the day, and increase overall TIR[13,14].

While CGM technology itself is not yet widely feasible in the setting of the PHC system in Indonesia, the frequent testing of blood glucose and HbA1c that the National Health Insurance facilitates offers a pragmatic alternative. This strategy addresses both short-term variability and long-term control, aligning with the principles underpinning CGM and reinforcing the imperative of frequent monitoring in diabetes management to enable timely interventions and improve outcomes. However, the findings identified barriers and facilitators to frequent blood glucose and HbA1c testing.

In this study, most respondents perceived inappropriate conditions of the patients as the main barrier to conducting blood glucose and HbA1c testing regularly. The study showed that many patients did not come in person to the PHC but were represented by family members or caregivers. This phenomenon is interesting to analyze because, according to the standard of care set by the Indonesian National Health Insurance, patients with chronic diseases (e.g., diabetes, hypertension) are supposed to visit the PHC regularly every month for a consultation with the physician, undergo examinations, receive diabetes education, and obtain medicine prescriptions to control the disease. After that visit, they must fill the prescriptions at the pharmacy. In other words, if patients are represented by their family members or caregivers, there will be no examinations for patients that healthcare providers, including blood glucose and HbA1c testing, can conduct. This can happen among diabetic patients who have physical disabilities (elderly individuals with difficulty walking, patients who have had a stroke, etc.), which creates a barrier for them to visit the PHC in person.

Physical disability is likely to occur in diabetes patients due to the comorbidities associated with diabetes. It manifests as impairments of multiple physiological and organ systems, such as the musculoskeletal, neurological, vascular, and

cardiorespiratory systems, that limit patients' daily living activities, and it contributes to poor adherence among patients to regular visits and prescribed medications[15,16]. A synthesis of published literature conducted by Dassah *et al*.[17] reported that a wheelchair was the primary mode of transportation used by patients with physical disabilities, and it seems to be one of the barriers for them to reach PHC.

On the other hand, many patients were physically able to come to PHC, but they did not. Patients' busy schedules and lack of transportation, especially for the elderly, were the main reasons for this issue. Previous studies showed that access to health facilities in terms of transportation availability is an important factor affecting health services utilization. Transportation is a critical step for ongoing access to healthcare facilities, particularly for patients with chronic diseases, as they require regular healthcare visits and access to medication to ensure continuity of care—the absence of adequate transportation results in delays in clinical interventions and monitoring. Furthermore, the elderly may experience access barriers due to disabilities and are likely to need frequent visits to healthcare facilities[18].

Irregular visits of patients to PHC lead to decreased frequency of blood glucose testing in diabetes patients, as most respondents stated that many patients not attending PHC result in the absence of blood glucose and HbA1c testing. In line with this, a previous study by Yadav *et al*.[19] also stated that healthcare access and patients' knowledge of blood sugar monitoring were associated with HbA1c testing frequency.

A study conducted by Widayanti *et al*.[20] showed that the problem of accessibility to PHC services can occur because they provide services during working hours, limiting the number of patients who cannot leave their work to visit PHC. This is related to some respondents' statements that patients choose to buy medications from pharmacies without a prescription rather than going to the PHC, as pharmacies are easier to access from their homes.

To overcome this problem, healthcare providers in PHC can implement the home visit program in chronic disease management of the National Health Insurance, where the patient and family are visited at home and provided with education and information about diabetes management. There would also be blood glucose testing to evaluate their conditions[7]. Some patients also stated they do not have a glucometer to check their blood glucose levels at home regularly. For patients who do not have financial conflicts, healthcare providers can also encourage them to obtain a glucometer as part of self-monitoring blood glucose practice and to continuously document and report the results to their physician and pharmacist.

For diabetes patients, fasting blood glucose and HbA1c are considered key indicators for evaluating glycemic control. An average glucose estimate derived from HbA1c and fasting blood glucose levels, calculated using the homeostasis model assessment (HOMA), helps assess the association between glucose and insulin balance during fasting. It estimates β-cell function by calculating the ratio of fasting insulin to fasting glucose concentrations. This highlights the importance of fasting before the testing procedure for diabetes patients. The lack of instructions from healthcare providers leads to patients' misconceptions about fasting[21].

A study conducted by DeWaters *et al*.[22] reported that patients who fast without clear guidance have potential medication-related adverse health events. They found that on the day of the laboratory testing, over 90% of patients with type 2 diabetes were taking insulin, and among them, 58% reported fasting before the procedures. Similarly, over 80% of those taking oral hypoglycemics, with 72% of them reporting fasting. It is associated with a greater risk of hypoglycemia and inconvenient conditions for patients.

In our study, some patients stated that they had difficulties fasting before the testing because they felt hungry and lacked energy while waiting in the queue at the PHC. This highlights the need to provide patients with standardized instructions and laboratory protocols before phlebotomy, including guidance on medication use, fasting procedures, and—importantly—the underlying reasons for fasting. Clear explanations can help improve patients' acceptance of fasting, enhance their safety, and ensure greater convenience during laboratory testing[22].

The testing of blood glucose and HbA1c is inherently linked to the use of needles, which many respondents identify as a significant barrier to regular testing. Although the needles used in testing procedures are relatively fine, fear, anxiety, and inconvenience associated with their use can still arise, contributing to low adherence to scheduled blood glucose testing. Additionally, patients often struggle to accept that their blood glucose levels may be elevated, as they interpret high blood glucose results as an indication of poor diabetes management. This situation fosters frustration, resulting in denial and decreased motivation to undergo regular blood glucose testing.

A similar finding from a study conducted by Ong *et al*.[23] reported that fear of needles, pain, and frustration were barriers for patients in self-monitoring their blood glucose levels. A qualitative meta-analysis reported by Brundisini *et al*.[24] also indicated that negative emotions such as fear, shock, frustration, guilt, and self-blame can influence patients' adherence to treatment. Based on these findings, healthcare providers are expected to assist diabetes patients in coping with negative feelings and emotions through education, counseling, and involvement in peer support groups. This approach aims to reduce emotional stigma and prevent these feelings from affecting their decision-making to regularly conduct blood glucose and HbA1c testing[25].

Some patients often perceive the frequent blood glucose and HbA1c testing as unnecessary, or they may lose motivation over time, attributing this to a lack of effort. Additionally, some patients are unaware that the National Health Insurance provides free laboratory testing for blood glucose and HbA1c, which can lead to missed testing appointments. Educating patients about the appropriate use of medications and medical diagnostics, including laboratory testing, is essential to enhance their health literacy and promote informed decision-making based on their current conditions and preferences[26].

Counselling and education incorporating the most relevant and up-to-date information from healthcare providers can significantly enhance individuals' understanding of the importance of continuous blood glucose and HbA1c testing[11,26]. Tang *et al*.[27] demonstrated that interventions consisting of educational newsletters from healthcare providers support diabetes self-management and significantly improve the practice of self-monitoring blood glucose levels. Healthcare professionals provide diabetes self-management education, which can be delivered by peer educators or community health workers[28]. Utilizing peer educators may also create networking and discussion opportunities for diabetes patients, thereby enhancing the effectiveness of diabetes self-management education[29].

Respondents believed that blood glucose and HbA1c testing are essential for evaluating the effectiveness of the diabetes medication patients take. In this context, blood glucose monitoring is critical for individuals with diabetes. It has been found to correlate with improved long-term glycemic control, reduced risk of complications, and enhanced quality of life[30,31]. Blood glucose measurement provides valuable information on the effectiveness of glucose metabolism and guides interventions aimed at achieving optimal glucose control within the body[1].

Since HbA1c measurement can inform adjustments to therapy regimens, patients who undergo more frequent monitoring may experience better diabetes management, thereby maintaining optimal HbA1c levels. A study by Schwandt *et al*.[32] reported that HbA1c testing is recommended to be performed quarterly, as it may encourage adherence to treatment among diabetes patients and increase motivation to achieve better metabolic control. The respondents also indicated that blood glucose and HbA1c testing assist physicians and pharmacists in gaining a better understanding of patients' medical conditions, enabling appropriate adjustments to drug dosages or therapy regimens when necessary. In other words, these tests provide evidence-based clinical decisions for healthcare providers[33]. Furthermore, there is a correlation between the frequency of HbA1c testing and the frequency of contact with healthcare providers, which may also influence the metabolic control[32].

Previous studies have identified cost as the most significant barrier to patient adherence in blood glucose monitoring[23]. However, in this study, costs are unlikely to impede patients' adherence to regular blood glucose and HbA1c testing, as the Indonesian National Health Insurance provides patients with free diabetes testing supplies, including monthly fasting blood glucose tests and biannual HbA1c testing, as reported by respondents. This provision enables healthcare providers to conduct the necessary testing and assists in monitoring patients' medical conditions, including evaluating medication effectiveness and safety.

Since the barriers to blood glucose and HbA1c testing primarily affect patients, healthcare providers must actively encourage patients, educate them, and provide information about the importance of these tests to enhance their awareness of diabetes management. Additionally, providers need to organize and communicate testing schedules to minimize the risk of patients forgetting their appointments. Providers are also expected to involve patients in diabetes education groups to improve their knowledge about their health, which is essential for recovery and preventing disease recurrence. This involvement aims to enhance patients' overall health status and ensure continuity in diabetes monitoring. Education and peer support groups have been shown to reduce the emotional impact of stigma and improve coping strategies, leading to better adherence to blood glucose monitoring among patients[23].

The findings of this study highlight a complex interplay of individual and organized, team-based healthcare systems that is reflected in the Indonesian national health insurance, supporting proactive chronic disease management. The involvement

of patients, physicians, pharmacists, and the health system ensures the care coordination and continuity of monitoring. This approach is crucial, as the most effective strategies for overcoming these challenges begin with a comparative analysis of the perspectives of all stakeholders, followed by a gap analysis and the development of implementable methods.

Although this study was carefully designed and conducted, several limitations remain. This study was conducted in selected primary care settings in Indonesia, including PHCs and pharmacies. As such, the findings may not be generalizable to other regions with different healthcare systems or cultural contexts. Therefore, future research should focus on further investigation to identify appropriate interventions and assess their effectiveness in promoting the imperative of frequent blood glucose and HbA1c testing for patients with diabetes.

CONCLUSION

This study affirms that regular blood glucose monitoring is crucial for effective diabetes management, a finding consistently acknowledged by all informants, including patients and healthcare providers. It is recognized as a key tool for improving glycemic control, fostering patient engagement, and ultimately reducing the risk of complications among Prolanis participants. However, the path to successful implementation faces significant barriers. Personal challenges, such as patient discomfort or disagreement with frequent testing schedules, often undermine adherence. Systemic obstacles are even more substantial, including the high cost of devices, limited access to reliable monitoring equipment, and ongoing uncertainty among clinicians regarding the relevance of frequent testing for all patient groups. Addressing these multifaceted challenges is essential to ensuring that regular blood glucose monitoring becomes a sustainable, accessible, and integral practice within Indonesia's national health system.

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AUTHORS' CONTRIBUTION

Conceptualization: Agnes Christie Rinda, Umi Athiyah, Andi Hermansyah
Data curation: Agnes Christie Rinda
Formal analysis: Agnes Christie Rinda
Funding acquisition: Umi Athiyah
Investigation: Agnes Christie Rinda, Umi Athiyah, Andi Hermansyah
Methodology: Umi Athiyah, Andi Hermansyah
Project administration: Umi Athiyah, Andi Hermansyah
Resources: Agnes Christie Rinda
Software: -
Supervision: Umi Athiyah, Andi Hermansyah
Validation: Umi Athiyah, Andi Hermansyah
Visualization: -
Writing - original draft: Agnes Christie Rinda
Writing - review & editing: Umi Athiyah, Andi Hermansyah

DATA AVAILABILITY

None.

CONFLICT OF INTEREST

The authors declared no conflict of interest associated with this work.

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