Research Paper

The Use of Electronic Information Technology on Self-management Among Diabetes Patients: A Qualitative Study

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ABSTRACT

Background: Electronic information technology (EIT) to improve self-management among diabetes patients has become a current trend in other countries. Thus, this study aimed to explore policymakers perspectives on EIT for self-management among patients with diabetes.

Methods: This research is a qualitative study using a phenomenological approach, conducted through in-depth interviews. Data analysis was carried out using the seven steps outlined by Polit and Beck. The research process was conducted from November 2023 to February 2024 at Roemani Hospital Semarang, Indonesia. The participants were 15 policymakers in the hospital recruited through purposive sampling.

Results: Three major themes emerged in this study: 1) Information through existing media is not effective (additional information needed can be accessed through the app; information through social media is not recommended in several hospitals, there are no special media for diabetes, only video; time constraints affect patients' ability to obtain health information); 2) Pros and cons of digital technology in hospitals (there are significant benefits of digital technology in hospitals, the effectiveness of technology can improve self-management in controlling the diet among patients, there are both positive and negative impacts on health services, understanding various perspectives regarding obstacles to the realization of technology is essential); and 3) Self-management education to increase self-awareness is needed (healthy behavior can be seen from self-management, and providing education based on patients preferences may improve diabetes self-management).

Conclusion: Digital technology can improve collaboration between health workers and patients, but its effectiveness may be reduced for those less familiar with technology.

Keywords: Diabetes, Self-management, Electronic information technology (EIT)

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Introduction

Diabetes is currently one of the chronic diseases that Indonesians are most concerned about. Indonesia is ranked fifth, with approximately 19.5 million people suffering from diabetes in 2021 [1]. Diabetes is a chronic metabolic disorder characterized by high blood sugar levels due to insufficient insulin function [2, 3].

According to the International Diabetes Federation (IDF), 537 million adults worldwide aged 20-79 years suffer from diabetes, and this number is expected to increase to 643 million (one in nine elderly) by 2030 and 784 million (one in eight elderly) by 2045 [1]. The estimated number of people with diabetes in Central Java Province in 2021 was 618,546 people, and 91.5% had received health services according to standards. There are 11 districts/cities with a percentage of health services for people with diabetes greater than 100%, while the district/city with the lowest achievement is Pemalang [4].

To improve the self-management of diabetic patients, the government has five pillars: Education, nutrition, diet, physical exercise and pharmacology [5, 6]. Diabetes self-management has been developed to improve the quality of life of diabetic patients, one of which is self-management [7–9]. These efforts still focus on the patient's perspective; however, self-management can help patients with diabetes at hospital discharge. Utilizing current electronic information technology (EIT) is one of the many ways to teach self-management [10–12]. One example is the development of EIT at an urban university hospital in Japan, Tokyo University Hospital, which treats patients with diabetes older than 20 years. The results showed that 16% of patients used information and communication technology (ICT)-based self-management tools, which made it easier and more effective for healthcare providers to disseminate such tools to patients [11].

Studies have shown that EIT can increase hospital productivity [11]. Android-based electronic information technologies can be developed, including diabetes care applications [13–15]. This application can be used as a reference for controlling blood glucose levels during type 2 diabetes treatment to reduce complications caused by uncontrolled blood glucose levels [16–18]. This indicates that there have been many studies and that EIT has become a trend in hospitals and various countries. However, many hospitals have not yet developed EIT as a key technology in the delivery of improved quality of care to diabetes patients. Before implementing EIT in Indonesia, there may be a need to change policymakers' views on EIT for diabetes patients to find gaps and solutions [19]. This research is crucial for addressing the issues that occur in Indonesia, specifically regarding diabetes control programs that exist in various health facilities but have not been fully optimized. Thus, the purpose of this study was to explore perspectives on improving diabetes self-management using EIT at hospitals in Semarang, Indonesia, by conducting in-depth interviews.

Methods

Study design

This qualitative research used a phenomenological approach.

Sample and location

The participants in this study were 15 policymakers at hospitals in Semarang City, including the general director, head of nursing, head of management information system (SIM), head of hospital health promotion, nurses, specialist doctors, pharmacists, and dieticians. The inclusion criterion was heads of the health sector and nurses with a work experience of at least five years. The samples were selected using purposive sampling. The method used for qualitative analysis was inductive. This research was conducted at Roemani Semarang Hospital. The in-depth interviews lasted approximately 20 minutes.

Data collection

This research was conducted from November 2023 to February 2024 at hospitals in Semarang. During data collection, the researcher began by identifying the location for the interviews. Each interview lasted approximately 20 minutes, and the information was gathered through both recording and note-taking. Before conducting the in-depth interviews, the researcher met with the participants in the designated room and provided informed consent forms, which were then signed by the participants to indicate their agreement to participate in the interviews. The researcher prepared interview aids and then conducted in-depth interviews with participants using the following questions) What do you think about the patient's perspective on the use of Android-based technology to improve the self-management of diabetic patients?; 2) What do you think about the use of Android-based technology to improve the self-management of diabetic patients, and what percentage of the recovery rate do you believe diabetic patients achieve?; 3) Is there EIT

in this hospital that can improve the self-management of diabetic patients?; 4) Do you think EIT in this hospital can improve the self-management of diabetic patients?; 5) Is the use of EIT in this hospital effective for diabetic patients to improve self-management?; 6) Are there any impacts or complications for diabetic patients regarding the use of EIT in this hospital? If so, please mention and explain.; 7) Why do you think EIT has not been able to be implemented in this hospital? The interview was conducted to explore participants' perspectives on efforts to improve self-management of diabetic patients using EIT. The interview activity concluded after all required information had been completely obtained.

Data analysis

Data analysis in this phenomenological research used the Collaizzi method, which aims to describe the meaning of an experience identified through the important themes of a phenomenon consisting of seven stages [20]: 1) Re-reading all interview data and field notes repeatedly to get a full understanding of what is contained in the interview results, without adding personal assumptions from the researcher; 2) The researcher reviewed the data and made a list of specific and significant questions about the phenomena presented by each participant; 3) The researcher articulated the meaning of each specific and significant question by selecting keywords; 4) The researcher grouped the keywords into categories and themes and also reviewed the original data to validate the groupings and noted the differences between the various groups to avoid the possibility of incompatible data or themes; 5) The researcher integrated the results into a description based on the themes that have been compiled; 6) The researcher formulated a complete description of the phenomenon under study in the form of clear statements and a basic structure; 7) The researcher validated the findings of the themes with the participants to ensure alignment with the circumstances experienced by them.

In qualitative research, saturated data are obtained when the data collected are sufficient to draw the necessary conclusions, and further data collection will not yield additional valuable insights. Data analysis in this study was manual. The interviewer was confident that the opinions expressed were authentic because they fully understood the content and what data were needed to address the questions posed to the researcher. Informed consent was provided to the researcher to ensure that no information was added or omitted. The information obtained was analyzed using open coding.

Rigor of study

The researcher obtained data through interviews with credentialed policymakers at the hospital. The participants consisted of both men and women. The participants included both men and women, with general occupations such as managing director, head of nursing, specialist, doctor, dietician, administrator, and pharmacist. They were researchers who have conducted many studies published in many journals. The participants were not related to each other. After an explanation from the researcher, the participants understood that the purpose of the study was to explore policymakers' perspectives on EIT and self-management among diabetic patients. A potential bias in this study is that the interviewer believes the opinions expressed are authentic because they fully understand the content and what data is needed to address the questions posed to the researcher. The methodology used in this study was phenomenology, and the sampling method was purposive sampling which involved face-to-face interviews with a total of 15 participants. None of the participants refused to participate; however, some preferred not to be recorded and requested that their responses be noted by hand instead.

The data were collected at the hospital, with important characteristics of the participants being assessed through demographic data, including age, gender and education. During the data collection process, there was no one present other than the researcher and the intended participants. The questions, instructions and guidelines provided by the researcher did not require testing; instead, repeated interviews were conducted 14 times. After identifying similarities with previous interviews, the researcher would stop the interviews to avoid wasting data in the future. This data collection utilized audio recordings and field notes made during interviews, which lasted approximately 20 minutes. In qualitative research, saturated data were obtained when the collected data were sufficient to draw necessary conclusions and further data collection will not yield additional valuable insights. Transcripts were returned to the researcher and corrected by the researcher to ensure no information was added or subtracted. In this study, three codes were obtained, which included themes, sub-themes and example quotes. The themes formed were derived from descriptions based on participant quotes, and the data was processed manually. Participants were asked to confirm that what they described reflected their own findings.

Table 1. Characteristics of the participants

No.	Age (y)	Gender	Education	Title
1.	27	Male	Diploma in nursing	Nurse
2.	43	Male	S1 administration	Head of hospital health promotion
3.	32	Male	S1 informatics engineering	Head of SIM
4.	51	Female	S2 nursing	Head of nursing
5.	55	Male	S2 management	General director
6.	39	Male	S2 pharmacist	Head of pharmacy department
7.	50	Female	S3 pharmacist	Head of pharmacy
8.	47	Male	S2 dieticians	Head of dietetics
9.	42	Female	S2 nursing	Head of nursing department
10.	45	Male	S3 nursing	Head of nursing department
11.	39	Male	Specialist doctor	Senior doctor and head of installation room
12.	51	Female	Specialist doctor	Senior doctor
13.	45	Male	Specialist doctor	Senior doctor and head of installation room
14.	36	Female	Specialist doctor	Senior doctor
15.	38	Female	Specialist doctor	Senior doctor

SIM: Management information system.

The themes were derived from the sub-themes, which were short descriptions derived from the participants' quotes. The researcher ensured that the data were consistent with the findings. Major themes were clearly presented in the findings, and four themes and minor themes derived from the descriptions of participant quotes were found.

Results

The participants in this study were heads of the health sector and nurses with a work experience of five years with an average age of 25 years and over. Characteristic of respondents presented in Table 1, further sub-theme of each theme presented in Tables 2, 3 and 4.

Understanding of the use of media to improve self-management through health information

The researcher identified the theme: Information through existing media is not effective.

Reasons for using EIT at hospitals for diabetic patients

Researchers identified a theme: The pros and cons of digital technology in hospitals. Patient understanding in recovery and the importance of providing education to diabetic patients. The researchers identified a theme: Self-management education to increase self-awareness is needed.

Discussion

Diabetic patients can obtain additional information through applications that provide monitoring and education. However, information obtained through social media is not recommended at several hospitals, as the primary source of information for patient education is video content from hospitals. Although there are no special media for diabetic patients, a need for the development of information tailored to the needs of diabetic patients in the hospital. Research supports the use of ICT in healthcare, but there is no research that demonstrates it is necessary. In Europe, only 14% of type 2 diabetes patients who used the web app consented to the study,

Table 2. Sub themes of self-management education to increase self-awareness is needed

Sub-theme 1: Additional Information Needed Can be Accessed Through the App.
Participant 11: "We can see, in terms of patients, that those who have diabetes need more information from hospital services, including doctors, nurses, and other health workers, so that there is reciprocity in diabetes care applications." Participant 2: "It is important and necessary to have a monitoring threshold for patients. When asked about the interests or perspectives of patients regarding information technology systems related to diabetes, it is essential that these systems are used properly. One example is the use of an Android-based application that addresses symptoms and treatment. Patients must be aware of various aspects related to diabetes, with the primary purpose being to monitor their health so they can maintain their well-being. Diabetic individuals often forget that they have diabetes, and frequent forgetfulness can lead to the development of other diseases. As we know, diabetes is often referred to as the mother of diseases." Participant 8: "From the perspective of the function mentioned earlier, the application is intended primarily to educate patients, meaning it is more focused on the patient's self-management." Participant 5: "From the patients' perspective: So far, diabetes patients at the hospital are number 2 and there are also many outpatient diabetes cases. Fortunately, applications are very much needed. It is clear that these applications should not be complicated; they need to be easy to use. For ordinary people, what is needed is a simple way to connect to the hospital, especially when it comes to diabetes. This includes information about diet, menus, exercises, medications and easy control."
Sub-theme 2: Information Through Social Media is Not Recommended in Several Hospitals.
Participant 7: "Well, I don't know about the application. First, I don't know about the diabetes care application, and second, the hospital may not direct the use of the application. Because if you are asked to explain the application, you don't understand, you might not understand it. At the very least, you should be able to explain the application, including its benefits, advantages, and disadvantages, especially to the general public who may not be familiar with diabetes. If they cannot use it, it is to anticipate the occurrence of diabetes." Participant 3: "For this hospital, information about diabetes is usually obtained through YouTube, Instagram and the friend application.".
Sub-theme 3: There is No Special Media for Diabetes; Only Videos are Available.
Participant 12: "Well, temporarily there is none. When talking about hospital health promotion, even though we are the head of the unit, we involve other units, meaning that we are structured as the head of the unit and we rely on counseling and support from other units, such as nurses and doctors from various service units, as well as support from content creators who help bring our content to life—content production in hospital health promotion. We want to utilize a self-made hospital application to engage patients, but it is still in the conceptual or study phase. For now, we cannot maximize or optimize digital resources for these patients. There are no specific media for diabetes videos, but the hospital does have some content related to health promotion, and diabetes-specific resources are still in the development stage." Participant 2: "For now, as long as I'm here, there is nothing special media specifically for diabetes self-management. If a hospital television channel already exists, that would be great." Participant 1: "So far, I have not received information whether it exists or not, but I think that if it turns out that technology can be applied, especially with technology that patients can access to obtain information about diabetes management more quickly, it would be beneficial. At the hospital, in terms of applications, there is a facility whose management is under hospital consideration, which includes many videos related to disease issues that patients can utilize. These videos are presented by expert doctors and can be accessed on the hospital's website or YouTube channel. God willing, they are all available. So, while there is no special media for diabetes videos, the hospital does have a YouTube channel, Roemani, which serves as a platform for providing education and counseling on disease issues."
Sub-theme 4: Time Constraints Affect Patients to Get Health Information.
Participant 14: "It's more about time constraints and access for patients because not all patients will see the information on the screen."

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while the rest did not consent due to lack of access to the Internet [21–23]. Therefore, it is essential to determine who is willing to use such tools for effective and low-cost diabetes management [24–27].

The use of technology in healthcare has both positive and negative impacts. Based on the results of this study, on the positive side, technology can improve the efficiency and accessibility of information. The effectiveness of digital technology is also evident in enhancing the self-management skills of diabetic patients, particularly in controlling their nutrition and diet. On the negative side, various constraints, including limited human resources, finances, and technological readiness, are obstacles to realizing the implementation of technology in hospitals in Semarang. There is supporting research on patients' willingness to use ICT in diabetes self-control [28–30]. With the rapid advancement of ICT, the use of the Internet and mobile devices is expected to help diabetes management. By enabling real-time and remote monitoring of data, such as blood glucose levels at home, these technologies can address time and loca-

Table 3. Sub themes of the pros and cons of digital technology in hospitals

Sub-theme 1: Significant Benefits of Digital Technology in Hospitals.
Participant 2: "It is very effective; for example, in diabetes and hypertension, if applied, it helps with health and can improve the efficiency and accessibility of information. The effectiveness of digital technology is also seen in improving the self-management skills of diabetic patients, especially in controlling their nutrition and diet." Participant 4: "God willing, it will improve. It was related to several factors that must be combined; it does not work alone, which means it requires cooperation between other health workers to realize the proper application of technology in hospitals." Participant 5: "Yes, we must strive to be able to because we cannot be separated from technology. Even if it needs to be improved and then maximized, it must be done. We cannot avoid the technology that is needed by the community, including patients."
Sub-theme 2: The Effectiveness of Technology Can Improve Self-management in Controlling the Diet Among Patients.
Participant 6: "This may provide insight into additional information about diabetes." Participant 2: "For now, there is none, but with information system technology, it can certainly address the needs of patients by providing additional information related to health. Participant 9: "It requires the consent of the related units; for example, from the medical field to ensure that diabetes is controlled, or from nutrition to manage the diet. This collaboration will be effective in improving self-management."
Sub-theme 3: There are Positive and Negative Impacts in Health Services.
Participant 12: "There is no impact and no complications." Participant 5: "There must be positive and negative aspects; other impacts must exist, and they must be mapped properly. We map the presence of patients in the hospital and the technology aspect is how, on average, people affected by diabetes are those aged 50 years and over."
Sub-theme 4: Understanding Various Perspectives Regarding Obstacles in the Realization of Technology.
Participant 10: "This is due to limited human resources, inadequate financial resources, and corruption related to personal protective equipment." Participant 13: "At the beginning, it was stated that the hospital has a video unit. Even though it is a unit, there is only one full-time unit head with limited human resources. It should be able to involve the SIM department to develop a technology-based application for diabetic patients to use. Why hasn't it been implemented? Because human resources are not fulfilled. There are two podcasts, four hospital counseling sessions, four flyers, posters, and leaflets used to deliver education to patients, along with four short videos and content. So, for now, the video aspect has not been able to progress in that direction, as we still have many content needs that we have not been able to fulfill for the general public. There is the hospital television channel, which should be enjoyed by patients, visitors, or families of patients, but the content is far from being adequate. Currently, the focus is on creating content, podcasts, short videos, and flyers, and providing health education directly at the hospital. If asked whether there is a desire to make an application, the answer is yes, but the approach must be well thought out—there is also a consultant model from the hospital. However, in the end, this incurs additional costs. So, for now, the focus is still on health promotion content at the hospital." Participant 3: "We can't look at one side and I also can't blame why it hasn't been implemented. It could be due to limited human resources. In fact, technology is more than capable of being implemented because it recognizes the developments that already exist. The technology is already available; we just need to start implementing it in terms of materials or other preparations so that patients can get additional health information. The hospital also utilizes it, but if we look at it from the IT perspective, it only facilitates the process." Participant 4: "It is not that it has not been implemented. Originally, information has been provided through the podcast, there is a diabetes mellitus (DM) day, and there is other information available. In this application, only one has been developed so far. Secondly, there is an application that can be accessed from home for patients, which is being developed for employees as well. Employees can report their absence from home and can find out how late they are. This is beneficial for patients, as they are still being considered for a sustainable, tiered application that will facilitate their healing and follow-up care." Participant 5: "As for information technology, actually we are gradually implementing it. The transfer of technology has been carried out in the hospital, but the stages have not yet reached completion. I think this needs to be prepared first from the human resource system, and then the equipment also needs to be prepared. As soon as it is ready, it can be implemented faster and accessed by the community."

tion challenges. However, some patients are not willing to use ICT-based self-management tools for several reasons, including feelings of burden, satisfaction with their current management activities, perceptions of difficulty in using the tools, boredom, lack of time, beliefs about ineffectiveness and concerns that their health condition is too poor to utilize them [31, 32].

Self-management efforts play an important role for patients in managing their condition. Involving social media as a tool to provide health education can be a fairly effective strategy, allowing patients to get more extensive and in-depth information. In diabetes self-management efforts, self-readiness and family support also play an important role [33, 34]. The presence of family as a source of support can provide motivation and practical assistance for patients, strengthening their ability to manage their diabetes more effectively. In Japan, only 36% of hospitalized diabetic patients were able to maintain improved hemoglobin (HbA1c) levels for two

Table 4. Sub themes of self-management education to increase self-awareness is needed

Sub-theme 1: Healthy Behavior Can be Seen From Self-management.
Participant 15: "If you ask about the possibilities, the recovery rate is 0% because the presence or absence of using the diabetes care application also depends on the patient's lifestyle. Irregular control of blood sugar levels can also affect the patient's recovery rate." Participant 8: "Actually, the healing process depends on the patients themselves. As a diabetic patient, I have to be able to monitor myself. For example, I need to keep my blood sugar normal by being careful with my diet and exercising. Even now, my blood sugar levels are very good, and I only take half the medicine. My condition has improved; I used to have to take a lot of medicine, but now I control it. The healing process, once again, depends on efforts made through self-management. Even if there is a wound, no matter how severe, if the patient's intention is undisciplined and inconsistent, it can affect their recovery. For example, diet management, emotional factors, and patterns of behavior all play a role in how diabetic patients manage their condition."
Sub-theme 2: Providing Education Based on Patients' Preferences May Improve Diabetes Self-management.
Participant 3: "If you look at the recovery rate, I can't answer that, it's far from clear because the information is also lacking. However, with education, it must improve their lifestyle, but I can't answer what percentage that would be." Participant 12: " Currently, health promotion information is provided on Instagram, including simplified videos and leaflets, as well as podcasts. There should be videos about diabetic diets or how to manage a diet from nutritionists. Sometimes, there is also information from hospital television channels, but it is not yet routine or interactive." "For effective participation, yes, when the patient is hospitalized, it is, of course, related to the caregiving profession, and they continue to be involved in the process. The main focus is education. If the application is available on the mother's cellphone, there must be information that can be shared before the patient is discharged. This information should be part of the patient's discharge planning. For example, in the case of a DM patient, what are the next steps? If there is a wound, what should be done? If there is no wound, what should be done? What kind of diet should be followed, and what kind of medication should be taken? Additionally, if there is an Android application, information related to diabetes is provided before the patient goes home, making it easier for the patient to understand and more willing to comply, as they will have been informed before returning from the hospital." "We have to educate patients that information is originally easy to understand, but if there are obstacles, such as the elderly patients, we need to involve their closest family members because they will be accompanying the diabetic patients. This is important since diabetic patients are, on average, 50 years old and above, and they require assistance."

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years, suggesting that self-management education and family support are essential for diabetic patients [5, 35, 36]. One way that nurses can assist diabetic clients in gaining knowledge and skills for diabetes self-management to prevent long-term complications is by providing health education [10, 37]. Understanding the importance of self-understanding is crucial for diabetes patients, especially in terms of maintaining a regular schedule, type, and amount of food, particularly for those taking blood glucose-lowering drugs or insulin. The extent, to which patients are self-aware and able to perform self-care aimed at controlling their symptoms and preventing complications is key to successful diabetes treatment. Self-awareness is important for people with diabetes to improve adherence to dietary management, physical activity, consumption of anti-diabetic medications, and the prevention of disease complications.

Conclusion

Several hospitals have not recommended the use of EIT for diabetic patients, even though there is some video content from hospital health promotion that does not fully meet the needs of diabetes patients. While digital technology can improve collaboration between health workers and patients, its effectiveness may be reduced for those less familiar with technology. Constraints, such as human resources, finances, and technology readiness can hinder the implementation of technology in hospitals. Education is recognized as key to improving patient understanding, especially in the context of diabetes self-management among the elderly. Social media can be a fairly effective strategy f for providing broader and deeper education. Family support and self-readiness also play an important role in motivating and assisting patients in managing their diabetes.

Ethical Considerations

Compliance with ethical guidelines

This study was approved by the Ethics Committee of Universitas Muhammadiyah Semarang, Semarang, Indonesia (Code: 313/KE/11/2023; dated December 11, 2023). Furthermore, during the study, the participants were in contact with the researcher by phone to solve possible problems and answer questions. To comply with ethical principles, participants were well-informed about the research.

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Authors' contributions

Conceptualization and writing: All authors; Methodology, investigation, and resources: Nayandra Keysha; Validation, formal analysis, data curation and supervision: Satriya Pranata.

Conflict of interest

The authors declared no conflict of interest.

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