VER
Vascular & Endovascular Review

Patient Safety Culture Model On Nurses' Understanding In Implementing Diabetes Mellitus Patient Safety

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ABSTRACT

This study aims to analyse how patient safety culture is implemented in Pekanbaru City health centres, and how nurses' understanding of patient safety implementation can affect the quality of care. This study used descriptive and explanatory research approaches. The study population consisted of 205 nurses working in 21 health centres in Pekanbaru City. The sampling technique used was total sampling. The instrument used to measure patient safety culture variables and nurses' understanding of diabetes mellitus patient safety was a questionnaire. Data analysis was performed using descriptive analysis techniques and Partial Least Squares. The results showed that there was a significant relationship between patient safety culture and nurses' understanding of diabetes mellitus patient safety implementation. In addition, nurse characteristics such as length of service, employment status, and age also have a significant effect on patient safety culture and diabetes mellitus patient safety implementation. Structural model analysis showed that this model could explain almost all the variation in nurses' understanding of diabetes mellitus patient safety implementation. Goodness of fit test results indicate that this model can be used to improve nurses' understanding of diabetes mellitus patient safety implementation. Implementation of a proper patient safety culture can improve the quality of care for patients with diabetes mellitus in community health centres. The importance of policies that support continuing education for nurses and job stability can strengthen safety culture and improve nurses' understanding of patient safety implementation.

KEYWORDS: diabetes mellitus; nurse understanding; patient safety culture; patient safety; health centre.

How to Cite: Anita Syarifah, Gusbakti Rusip, Tiarnida Nababan, Dewi Sartika., (2025) Patient Safety Culture Model On Nurses' Understanding In Implementing Diabetes Mellitus Patient Safety, Vascular and Endovascular Review, Vol.8, No.10s, 223-230.

INTRODUCTION

The rising global burden of diabetes mellitus (DM), a chronic metabolic disorder characterized by sustained hyperglycemia, has presented significant challenges for healthcare systems worldwide (Alqadi, 2024). According to the International Diabetes Federation (IDF), the number of individuals living with diabetes is projected to reach 643 million by 2030, emphasizing the urgency of safe and effective care practices. Among the most critical concerns in managing DM patients is ensuring **patient safety**, especially in clinical settings where complex medication regimens, comorbidities, and acute complications pose substantial risks (WHO, 2024). The disease can lead to various serious complications such as neuropathy and diabetic retinopathy, which in turn affect the patient's sensory, motor and autonomic functions (American Diabetes Association, 2020). It is evident that DM remains a chronic condition which is increasingly prevalent on a global scale. A substantial body of research has demonstrated that in excess of 50% of individuals diagnosed with diabetes on a global scale are not undergoing medication to manage their condition. This phenomenon is particularly evident in low- and middle-income countries, where treatment rates are found to be lower in comparison to high-income regions (Wahyuni, 2021).

In 2021, it was estimated that diabetes and kidney-related complications were responsible for more than two million deaths, while approximately 11% of deaths from cardiovascular disease were attributable to high blood sugar levels (WHO, 2024). Furthermore, Indonesia has been identified as a nation with a high prevalence of diabetes, ranking fifth globally with an estimated 19.5 million cases in 2021. Projections indicate that this figure is anticipated to rise to 28.6 million by 2045 (IDF, 2024). The increasing prevalence of diabetes mellitus is also a major challenge in health management at the primary level, especially in community health centres. A study in Poland showed that while patient safety culture receives great attention in hospitals, its implementation in primary health facilities, such as health centres, still faces major challenges. Successful implementation of a safety culture relies heavily on interprofessional collaboration and ongoing policy support (Alqadi, 2024).

In Riau Province, especially in Pekanbaru City, the number of DM patients in 2023 reached 18,044 people, with 10,094 cases recorded in 21 health centres. This increase in the number of patients presents a major challenge for local health facilities in treating DM patients, which often leads to complications such as neuropathy and diabetic foot ulcers (Health Office of Riau Province, 2023). These complications increase the risk of infection and decrease the patient's motor function (Tharani et al., 2025). Consequently, effective, and cautious management of DM patients is imperative to avert such complications. The paramount concern in healthcare settings is patient safety, a fundamental principle that must be upheld in primary health facilities, including community health centres (puskesmas).

The importance of patient safety in every medical interaction cannot be overstated, particularly in the context of caring for individuals diagnosed with diabetes mellitus. Patients have the right to safe care, clear information about their health condition, and the right to give consent or file a complaint if they feel their rights are violated or the care they receive is inadequate (Asadinejad & Asadinejad, 2022). Inadequate attention to patient safety can lead to adverse events (AEs), whose incidence in hospitalised patients can range from 3% to 16% in many countries. In Indonesia, the reported incidence of adverse events (AEFIs) shows varying incidence rates between regions, with Jakarta recording a very high incidence rate of 37.9%. Therefore, the implementation of an effective patient safety culture in healthcare facilities is essential to reduce the incidence of adverse events and improve the quality of care.

Diabetes mellitus (DM) is a chronic metabolic disease that continues to increase in prevalence worldwide (Ghafar et al., 2024). It has been demonstrated by preceding studies that a patient safety culture has the capacity to enhance the quality of care, reduce the risk of medical errors, and prevent complications in patients with diabetes mellitus (DM) (Kuznetsova & Moiseeva, 2024; Wahyuni, 2021). However, the implementation of patient safety in diabetes mellitus care still requires more comprehensive and structured educational interventions to improve understanding and implementation of patient safety among nurses (Etemadifar et al., 2021). In addition, more integrative nursing education with patient safety principles is also needed to establish a strong safety culture among nurses, which in turn affects patient care outcomes (Choi & Kim, 2024; Gore & Schrems, 2025). Further research should also explore the role of specialised nurses in improving patient safety, particularly in patients with diabetes (Glarcher & Vaismoradi, 2024). Hospital and healthcare facility management support of a patient safety culture has also been shown to be important, but has not been widely explored in the context of diabetes care (S. E. Lee & Dahinten, 2020).

A paucity of research has been conducted on the implementation of patient safety culture in diabetes mellitus care at health centres, particularly with regard to the influence of nurse characteristics, such as length of service, employment status, and age, on safety culture and nurse understanding. This study emphasises the integration of nurses' individual factors (characteristics) in the implementation of patient safety culture in primary health facilities, especially health centres in Pekanbaru City. This study contributes to the existing body of knowledge by deepening the understanding of the relationship between patient safety culture and nurse characteristics. Furthermore, it provides insight into how nurses' role in improving diabetes mellitus patient safety implementation can be optimised through policy and continuing education. This study underscores the dearth of profound comprehension concerning the implementation of patient safety culture in diabetes mellitus care in community health centres, particularly in relation to the influence of nurses' characteristics, such as length of service, employment status, and age, on safety culture and their cognisance of it. The present study also emphasises the importance of integrating nurses' individual factors in the implementation of patient safety culture in primary health facilities, especially health centres in Pekanbaru City. The objective of this study is to analyse the implementation of patient safety culture in health centres in Pekanbaru City, and to explore the impact of nurses' understanding of patient safety implementation on the quality of care. This study enhances the comprehension of the relationship between patient safety culture and nurse characteristics, thereby offering novel insights into the optimisation of nurses' role in enhancing diabetes mellitus patient safety through policies and continuing education. This study aims to develop and validate a **Patient Safety Culture Model** that captures the dimensions of nurses' understanding and its application in implementing DM patient safety. Through this model, healthcare institutions can identify critical gaps, design targeted interventions, and reinforce a culture that prioritizes both safety and quality in chronic disease management.

The management of diabetes mellitus (DM), a chronic and high-risk condition, requires precise, consistent, and safe healthcare practices. As the global prevalence of DM continues to rise, so does the complexity of patient care and the potential for adverse events particularly those related to medication errors, inadequate monitoring, and miscommunication. Nurses, who serve as the frontline caregivers, play a central role in ensuring the safety of DM patients through accurate insulin administration, early detection of complications, and continuous patient education. However, evidence shows that many adverse events in diabetic care are still linked to a lack of safety awareness, inconsistent adherence to protocols, and insufficient organizational safety culture. Although the concept of patient safety culture (PSC) is widely recognized as a key factor in reducing healthcare errors, current models are often general and not disease-specific. This gap limits their effectiveness in guiding safety practices within the unique context of DM care. Therefore, it is urgent to develop a targeted approach that specifically addresses how nurses' understanding of PSC translates into safe practice for patients with diabetes.

This study introduces a novel model of patient safety culture that is specifically designed for diabetes mellitus care and centered on nurses' comprehension and implementation behaviors. Unlike existing frameworks, this model integrates both cognitive (knowledge and perception) and behavioral (practice and application) dimensions of safety culture, specifically tailored to the complex clinical demands of DM management. By bridging the gap between theoretical understanding and practical implementation, the proposed model provides a contextualized tool for evaluating and strengthening safety practices in DM patient care. Furthermore, it offers new insights into how organizational culture, individual competencies, and clinical environments interact to shape nursing behavior, especially in chronic disease management. This novelty not only fills a critical gap in the literature but also offers practical implications for healthcare systems aiming to improve patient safety outcomes through disease-specific, nurse-centered strategies.

METHOD

This study used a non-experimental quantitative method with a descriptive analysis approach and explanatory research to explain the relationship between patient safety culture and nurses' understanding of diabetes mellitus patient safety implementation, as well as the influence of nurse characteristics (length of service, status, and age). This study used a survey

method with a questionnaire to measure these variables. The study was conducted in 21 health centres in Pekanbaru City, with implementation from April to December 2024. The population in this study were nurses working in 21 health centres in Pekanbaru City, with a total number of 205 nurses. This population was chosen because they were directly involved in the implementation of diabetes mellitus patient safety. The sample of this study was taken using the Total Sampling technique, in which all nurses who met the criteria in the population were sampled, namely 205 nurses. The inclusion criteria in this study were respondents who had a minimum educational background of Diploma in Nursing or Associate Degree in Nursing, were not on leave (either annual leave, marriage, childbirth, or illness) during the research process, were not on study assignments or attending education / training that left their duties at the hospital and were willing to become respondents as evidenced by signing a letter of willingness to become a respondent. Exclusion criteria in this study were respondents who did not fulfil any of the above inclusion criteria, such as nurses who were on sabbatical or not actively working during the data collection period. The data collection process commences with the meticulous preparation of the measuring instruments utilised in this study. The measuring instruments utilised in this study encompassed tools designed to assess patient safety culture and the comprehension of nurses regarding the implementation of diabetes mellitus patient safety within nursing services. The preparation of this instrument involves the drafting and duplication of research instruments. In addition, the measuring instrument was subjected to rigorous testing to ascertain its validity and reliability. The instrument for measuring patient safety culture used was The Hospital Survey on Patient Safety (HSOPS), which consists of 12 elements. The instrument designed to evaluate nurses' comprehension of the implementation of diabetes mellitus patient safety was subjected to a preliminary evaluation through the distribution of questionnaires to 30 respondents at health centres in Kampar District. The results of the pilot test showed that the instruments used were valid because the calculated r value for the instrument items was greater than the r table value, and reliable with a Cronbach's Alpha value > 0.7. The invalid instrument items were then improved in terms of sentence structure and language, and after improvement, the instrument was used in the main research. After the instrument was declared valid and reliable, data collection was carried out by first measuring patient safety culture and nurses' understanding of the implementation of diabetes mellitus patient safety. The researcher explained the purpose and objectives of the study to the respondents, and if the respondents agreed, they were asked to sign an informed consent before filling out the questionnaire. Data analysis in this study used two main techniques, namely descriptive analysis and Partial Least Squares (PLS) analysis.

RESULT

The complexity of diabetes mellitus care presents significant risks to patient safety, requiring not only clinical competence but also a strong understanding and application of patient safety culture among nurses. As key healthcare providers in both inpatient and outpatient settings, nurses' perceptions, attitudes, and practices related to safety culture greatly influence the quality and safety of care delivered to diabetic patients. However, the absence of a specific model that connects nurses' understanding of safety culture with the implementation of diabetes mellitus patient safety strategies highlights a critical gap in the current literature and practice.

Table 1. Distribution of Respondent Characteristics (n=205)

Category	Frequency (n)	Percentage (%)
Age		
26-30 years old	20	9,8
31-35 years old	15	7,3
36-40 years old	63	30,7
41-45 years old	73	35,6
46 > years old	34	16,6
Gender		
Male	36	17,6
Female	169	82,4
Length of Service		
1-10 year(s)	71	34,6
11-20 year(s)	100	48,8
21-30 year(s)	34	16.6
Marital Status		
Marries	188	91,7
Not Married	17	8,3
Employment Status		
Civil Servants (PNS)	165	80,5
Government Employees with Work Agreements (PPPK)	20	9,8
Honorary employee	20	9,8
Total	**205**	**100**

Table 1 shows the distribution of respondents' characteristics based on age, gender, length of service, marital status, and employment status. A total of 205 respondents were involved in this study, with the majority aged between 41-45 years (35.6%), female (82.4%), and had worked between 11-20 years (48.8%). The majority of respondents were married (91.7%) and employed as civil servants (80.5%)

Table 2. Data Distribution of Safety Culture and Nurses' Understanding of DM Patient Safety Implementation in Pekanbaru City (n=205)

Variable	Frequency (n)	Percentage (%)
Involvement *(Informed Culture)*		
Optimal	93	45,4
Not Optimal	112	54,6
Justice or Fairness *(Just Culture)*		
Optimal	91	44,4
Not Optimal	114	55,6
Reporting *(Report Culture)*		
Optimal	102	49,8
Not Optimal	103	50,2
Learning *(Learning Culture)*		
Optimal	76	37,1
Not Optimal	129	62,9
Nurses' Understanding of DM Patient Safety Implementation		
High	89	43,4
Low	116	56,6
Total	**205**	**100**

Table 2 shows the distribution of data related to safety culture and nurses' understanding of the implementation of DM patient safety in Pekanbaru City. Of the 205 respondents, most showed a suboptimal safety culture in the variables of involvement (54.6%), fairness (55.6%), learning (62.9%), and reporting (50.2%). In addition, more than half of the nurses had a low understanding of DM patient safety implementation (56.6%).

Table 3. Results of the Inner Model Test of Patient Safety Culture on Nurses' Understanding of the Implementation of Diabetes Mellitus Patient Safety

Relationship	Original Sample	Mean Sample	Deviation Standar	T Statistics	Desc
Patient Safety Culture with Nurses' Understanding of Diabetes Mellitus Patient Safety Implementation	0,029	0.029	0,014	2,140	sig
Nurse Characteristics with Patient Safety Culture	0,184	0,192	0,060	3,065	sig
Nurse Characteristics with Diabetes Mellitus Patient Safety Implementation	0,983	0,983	0,006	165,386	sig

Table 3 shows a significant relationship between patient safety culture and nurses' understanding of diabetes mellitus patient safety implementation with a path coefficient of 0.029 and a T-statistic value of 2.140 (t > 1.96). The positive sign indicates that the higher the patient safety culture, the stronger the nurses' understanding. In addition, the relationship between nurse characteristics and patient safety culture (path coefficient 0.184, t = 3.065) and nurse characteristics and diabetes mellitus patient safety implementation (path coefficient 0.983, t = 165.386) were also significant, indicating that the higher the nurse characteristics, the stronger the patient safety culture and patient safety implementation.

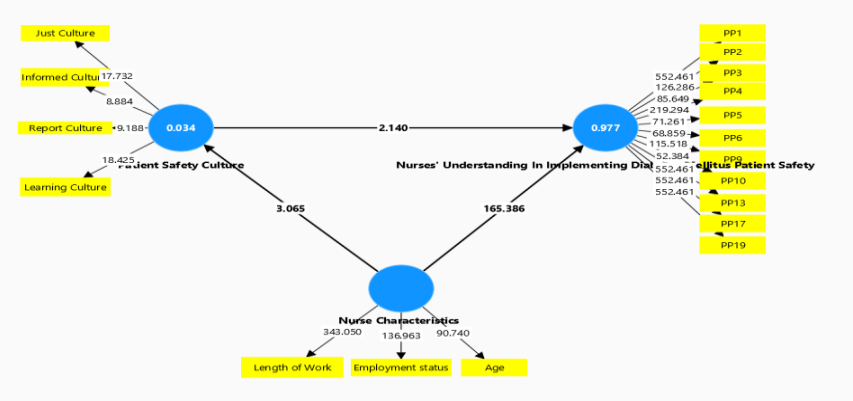

Figure 1. Results of Structural Analysis Model of Patient Safety Culture on Nurses' Understanding of the

Implementation of Diabetes Mellitus Patient Safety

Figure 1 shows the structural model illustrating the relationship between nurse characteristics, patient safety culture, and nurse understanding of diabetes mellitus patient safety implementation. All relationship paths show positive coefficient values, indicating a unidirectional and meaningful relationship between latent variables in the model. Based on the figure, the indicator with the highest loading value on patient safety culture is the learning construct, on nurse characteristics is length of service, and on nurses' understanding of the implementation of diabetes mellitus patient safety is the construct of injury prevention education for DM patients.

Table 4. R square Patient Safety Culture on Nurses' Understanding of Diabetes Mellitus Patient Safety Implementation

Variable	*R square*
Patient Safety Culture	0,034
Nurses' Understanding of Diabetes Mellitus Patient Safety Implementation	0,977

Table 4 shows the R square values for the relationship between patient safety culture and nurses' understanding of diabetes mellitus patient safety implementation. The R square value for patient safety culture is 0.034, which indicates a small contribution to the variation in nurses' understanding. Meanwhile, the R square value for nurses' understanding of diabetes mellitus patient safety implementation was 0.977, indicating that this model explained almost all of the variation in the dependent variable.

For model evaluation, These results show that the model has a Q^2 value close to 1, which means that this model is good and can be used to improve nurses' understanding of the implementation of diabetes mellitus patient safety.

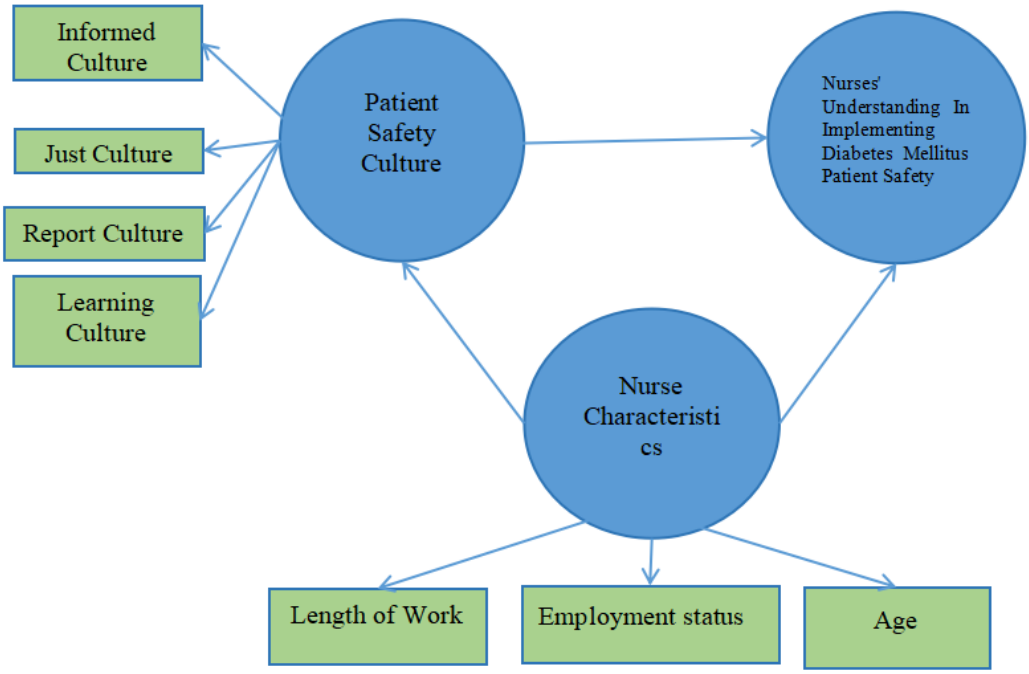

Figure 2. Conceptual Model of Diabetes Mellitus Patient Safety Implementation

Figure 2 illustrates the relationship between patient safety culture, which consists of four main constructs: Fairness, Involvement, Reporting, and Learning, with nurses' understanding of diabetes mellitus patient safety implementation. In addition, nurses‘ characteristics, including Length of Service, Status, and Age, are associated with safety culture and nurses’ understanding. These relationships are depicted with arrows showing the influence between variables in the context of diabetes mellitus patient safety implementation.

DISCUSSION

The findings of the study demonstrated a significant relationship between patient safety culture and nurses' comprehension of the implementation of diabetes mellitus patient safety. The study revealed a path coefficient of 0.029 and a T-statistic of 2.140 ($t > 1.96$), indicating a unidirectional positive effect. It can thus be concluded that an elevated patient safety culture is indicative of a more profound comprehension among nurses regarding the implementation of safety measures for patients with diabetes

mellitus. The validity of the indicators that comprise the patient safety culture, including fairness, involvement, reporting, and learning, was confirmed through the implementation of good outer loading techniques. This finding is consistent with the findings of previous research, which demonstrates a significant relationship between patient safety culture and the implementation of patient safety measures (Y. mi Lee & Oh, 2020). Other studies have shown that interventions that support a culture of safety have a positive impact on patient clinical outcomes, patient satisfaction, and the confidence of medical personnel in providing care, especially in patients with diabetes mellitus (Tremblay et al., 2020). Further research found that safety culture enablers exist at different levels, from individual to structural, and require strong policy support for sustainability of interventions (Tremblay et al., 2021).

In order to enhance the implementation of patient safety culture, healthcare facilities should concentrate more on fortifying the four fundamental elements of safety culture: fairness, engagement, reporting, and learning in every aspect of care. Furthermore, it is imperative to establish an environment that fosters learning from errors and encourages incident reporting without the fear of retribution. This objective can be accomplished through the integration of in-depth, ongoing training on patient safety measures within the policies of hospitals or health centres. This approach enables nurses to develop a more profound understanding of the significance of diabetes mellitus patient safety and to engage proactively in enhancing the quality of care.

Research on diabetes mellitus patients' perceptions of patient safety in Indonesia shows that positive perceptions of patient safety are important to create a sense of security and comfort for patients (Cui et al., 2021; Groves et al., 2023). Research in Germany also found that patient safety culture has a significant effect on patient safety incidents in hospitals (Sturm et al., 2019). The four indicators in patient safety culture, namely justice or fairness (Just Culture), involvement (Informed Culture), reporting (Report Culture), and learning (Learning Culture) are important elements in creating a safe environment for patients. Just Culture enables improvement after mistakes, Informed Culture promotes transparency in communication, Report Culture motivates incident reporting without fear of punishment, and Learning Culture supports continuous learning to improve patient safety. All these elements play a role in improving the quality of care and patient safety, especially in patients with diabetes mellitus, in accordance with the guidelines issued by WHO (WHO, 2025).

The findings regarding nurses' characteristics also provide important insights for human resource management in health facilities. Based on the results of the study, there was a significant relationship between nurse characteristics and patient safety culture, with a path coefficient value of 0.184 and a T-statistic of 3.065 ($t > 1.96$). This means that the higher the characteristics of nurses, the stronger the implementation of patient safety culture. The validity of nurse characteristics indicators such as length of service, employment status, and age has been proven, while gender and marital status have no significant effect in this study. This finding is in line with previous research which states that people who work more than five years in the hospital have stronger implementation of patient safety culture (Azyabi et al., 2021; Roth et al., 2021). Some studies have also mentioned that length of service can improve patient safety culture (Berry et al., 2020; Kakemam et al., 2021). Length of service is often associated with perceptions of patient safety, the more experienced nurses are, the better their perception of patient safety, which can reduce patient safety incidents (Granel et al., 2022; Peñataro-Pintado et al., 2021). Joint Commission International (JCI) accreditation also suggests that a strong safety culture requires a uniform perception of the importance of safety and prevention (Masci et al., 2024). Previous systematic reviews added that the longer nurses work, their skills and knowledge increase, which strengthens their commitment to their duties (A. Pool et al., 2021).

Therefore, policies in healthcare facilities need to consider nurses' length of service and experience as important factors in improving the quality of patient safety. Implementing policies that support continuing education for nurses and encourage learning from practical experience can help improve understanding and implementation of patient safety procedures. In addition, clear policies regarding employment status can also contribute to improving the quality of patient safety. This study showed that nurses with permanent employment status were more involved in implementing a patient safety culture compared to contract nurses. This emphasises the importance of policies that support job stability for nurses so that they can be more committed to implementing high safety standards (Falatah et al., 2021; Pressley & Garside, 2023).

This study also showed that the age of nurses had a significant relationship with the implementation of patient safety culture. Previous findings in Riau Province, Indonesia, showed that the majority of nurses aged between 36 to 45 years tended to have a better safety culture (Yeni Yarnita, 2019). Nonetheless, although age does not always have a significant effect on safety culture, research shows that older nurses are often more reliable and have a higher commitment to implementing safety procedures (Ann & Blum, 2020). Another study also revealed a relationship between age and accuracy in patient identification, which contributes to improving the quality of patient safety care (Hilda et al., 2023; Janeiro-Ochoa et al., 2025).

It is an established fact that the cognitive functions of nurses, including their decision-making abilities, undergo change with advancing age. As cognitive abilities such as working memory undergo deterioration, other processes, including practical experience accumulated over the course of a lifetime, demonstrate remarkable resilience (Zakirov & Krasilnikov, 2020). Older adult nurses often rely on their vast life experience, which can improve decision-making, especially in familiar contexts. However, the decline in executive function ability and information processing speed that often occurs with age, may affect decision-making, especially in complex or novel situations. Therefore, although older nurses have better maturity in making appropriate decisions, their cognitive limitations should still be considered in the context of implementing a patient safety culture. Overall, length of service, employment status, and age play a major role in improving the understanding and implementation of diabetes mellitus patient safety.

It is imperative to acknowledge the limitations of this study when interpreting the findings. Firstly, despite employing a non-experimental quantitative design with an explanatory research approach, this study is unable to confirm a direct cause-and-effect relationship between the variables studied. Furthermore, the sample population was restricted to pus sekted in Pekanbaru City, which may have implications for the generalisation of the results to other areas. Secondly, the study measured nurse characteristics only, such as length of service, employment status, and age, while other variables, including level of education and specific experience in diabetes mellitus care, have not been taken into account. Thirdly, the reliance on self-reporting by respondents in this study may be subject to social bias or bias in the desire to provide answers that are regarded as favourable.

CONCLUSION

A significant relationship between patient safety culture and nurses' understanding of the implementation of diabetes mellitus patient safety. A strong safety culture reflected in the dimensions of fairness, involvement, reporting, and learning contributes meaningfully to the development of a safe care environment and enhances nurses' comprehension of safety practices, particularly in the management of chronic conditions such as diabetes mellitus. Furthermore, nurse-specific characteristics, including length of service, employment status, and age, were found to significantly influence both patient safety culture and the implementation of safety measures. In contrast, gender and marital status showed no significant effect. These findings highlight the importance of recognizing individual professional backgrounds and demographic factors when formulating strategies to improve patient safety outcomes. It is therefore recommended that healthcare institutions strengthen safety culture through continuous education and training programs, while also considering the unique characteristics of nursing staff particularly clinical experience and employment conditions. By fostering a culture that emphasizes fairness, open communication, non-punitive reporting, and continuous learning, healthcare facilities can improve nurses' capacity to implement effective and sustainable patient safety practices, especially for patients with diabetes mellitus.

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