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Factors Affecting Medication Adherence among Patients with Type 2 Diabetes: A Review

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Abstract
Medication adherence plays a crucial role in the management of type 2 Diabetes Mellitus (T2DM), especially to prevent complications and improve the quality of life of patients. However, the very low level of patient adherence harms the effectiveness of therapy and their overall health. This study's purpose was to identify and analyze factors that influence medication adherence in T2DM patients. This study used the Systematic Literature Review method by reviewing relevant studies from journal platforms such as ScienceDirect, Google Scholar, Garuda Portal, and BMC Public Health. A comprehensive search strategy was implemented across the specified databases with a total of 17, 817 articles. After careful screening, six articles were considered relevant for the review. Inclusion criteria focused on age, gender, and education level. The results of the study showed that age factors have a significant relationship with adherence, where older patients tend to have lower adherence due to the complexity of the treatment regimen and cognitive impairment. Gender factors also have an influence, with several studies showing that women have higher adherence levels than men. In addition, education plays an important role in improving patient's understanding of treatment, and patients with higher levels of education tend to be more adherent to undergoing medical therapy. In conclusion, these findings confirm that education-based interventions and approaches tailored to age groups, gender and education can improve patient adherence to T2DM treatment. This finding can be a reference for future studies to identify more factors affecting medication adherence among DM patients.

Keywords: Type 2 Diabetes Mellitus; Medication Adherence; Age; Gender; Education.

1.0 Introduction

Recent societal transformations have significantly influenced dietary habits and physical activity levels, leading to notable public health concerns. As highlighted by Astutisari *et al.* (2022), modern lifestyles characterized by sedentary occupations—such as office-based work—have reduced opportunities for outdoor activities and physical exercise. Concurrently, there has been a shift toward diets high in processed foods and low in nutritional value. These lifestyle changes contribute to the rise of non-communicable diseases (NCDs), including degenerative conditions such as cardiovascular disease and type 2 diabetes mellitus. Diabetes, in particular, is closely linked to poor dietary patterns and physical inactivity, emphasizing the

need for comprehensive health interventions that address both nutrition and exercise in the context of evolving social behaviors.

Diabetes mellitus (DM) is a chronic, non-communicable, and potentially life-threatening metabolic disorder characterized by persistent hyperglycemia due to impaired insulin secretion, insulin action, or both. It is primarily associated with dysfunction of the pancreatic organs and involves disturbances in the metabolism of carbohydrates, lipids, and proteins (Fatmona *et al.,* 2023; Kurniastuti *et al.,* 2024; Lestari *et al.,* 2021). Among its classifications, type 2 diabetes mellitus (T2DM) is the most common form and has become one of the leading global public health challenges (Yao *et al.,* 2021). The pathophysiology of T2DM involves a combination of insulin resistance, particularly in muscle and liver tissues, and progressive loss of pancreatic beta-cell function. Recent studies suggest that beta-cell dysfunction occurs earlier and is more severe than previously thought. In addition to pancreatic impairment, several other organs contribute to glucose dysregulation in T2DM. These include the brain, which exhibits central insulin resistance; the kidneys, which show increased glucose reabsorption; the pancreatic alpha cells, which lead to hyperglucagonemia; the gastrointestinal tract, where incretin hormone production is deficient; and adipose tissue, where enhanced lipolysis exacerbates insulin resistance (Abhilash *et al.,* 2023; Soelistijo, 2021). Understanding this complex, multi-organ involvement is essential for the development of effective therapeutic strategies aimed at early intervention and long-term management of type 2 diabetes mellitus.

DM has emerged as a major global health challenge, with its prevalence increasing significantly over recent decades. According to Pratiwi *et al.* (2022), data from the World Health Organization (WHO) indicated that 422 million people worldwide were affected by DM as of May 2020. Alarmingly, Indonesia ranks fourth globally in the number of individuals with DM, following China, India, and the United States. The disease burden in Indonesia is projected to rise sharply, with an estimated 21.3 million cases by 2030. This trend reflects a broader national concern, as the prevalence of DM in Indonesia increased from 10.3 million in 2017 to 19.5 million in 2021 and is expected to reach 28.6 million by 2045, according to the International Diabetes Federation (IDF). Furthermore, Indonesia was ranked fifth in the world for the number of individuals aged 20–79 diagnosed with DM in 2021, underscoring the widespread nature of the disease (Dungga & Indiarti, 2024). Regional comparisons also highlight Indonesia's significant burden, with Helmi *et al.* (2024) reporting that of the 41,817 DM cases in the ASEAN region in 2022, 16,443 occurred in Indonesia—making it the country with the highest number of DM cases in Southeast Asia. These statistics emphasize the urgent need for national strategies focusing on the prevention, early detection, and management of diabetes mellitus to address this escalating public health issue.

DM is a complex chronic disease influenced by a range of demographic, behavioral, and physiological factors. These include gender, age, marital status, education level, occupation, physical activity, alcohol and tobacco consumption, body mass index (BMI), and waist circumference (Abhilash *et al.,* 2023; Sagita *et al.,* 2020; Suprapti *et al.,* 2023). Effective management of DM requires an integrated approach combining pharmacological interventions prescribed by healthcare providers with lifestyle modifications, such as healthy dietary practices and regular physical exercise. Inadequate management of DM can lead to progressive and irreversible complications, including diabetic nephropathy, cardiovascular disease, retinopathy, and neuropathy. These complications not only deteriorate the patient's health status and quality of life but also impose a substantial financial burden on healthcare systems (Pourhabibi *et al.,* 2022b; Rizal & Hariawan, 2024; Yusransyah *et al.,* 2022). Comprehensive management strategies for DM involve regular blood glucose monitoring, consistent medication use, dietary regulation, physical activity, and continuous patient education. Among

these components, medication adherence is a critical determinant of successful glycemic control, which is essential in preventing or delaying diabetes-related complications. However, studies have shown that DM has one of the lowest adherence rates among 16 major chronic diseases, with only 67.5% of patients complying with medical recommendations (Bravo-Garcia *et al.,* 2025; Hussain *et al.,* 2025; Ningrum, 2021; Pourhabibi *et al.,* 2022a). Therefore, enhancing medication adherence and reinforcing multidisciplinary management strategies are crucial to reducing the individual and societal burden of diabetes mellitus.

Medication adherence is a critical determinant of glycemic control in patients with T2DM (Wulandari *et al.,* 2020). Adherence to therapy, including both pharmacological treatment and lifestyle modifications, plays a pivotal role in the overall effectiveness of diabetes management. Without proper adherence, optimal treatment outcomes are unlikely to be achieved, regardless of the efficacy of the prescribed medications. According to the World Health Organization (2012), adherence is defined as the extent to which a person's behavior in taking medication, following a diet, and implementing lifestyle changes corresponds with agreed recommendations from healthcare providers. Poor adherence can result in suboptimal glycemic control, leading to the progression of disease and an increased risk of complications. Therefore, improving adherence to treatment regimens is essential for achieving long-term therapeutic success and preventing the worsening of the patient's clinical condition (Agustine & Welem, 2018).

Several studies show that adherence to the use of antidiabetic drugs is still low, even though this is strongly related to the expected therapeutic effects in DM patients. Age, gender, occupation, education level, medication adherence, and length of diabetes all affect the quality of life of DM patients (Mpila *et al.,* 2023). The purpose of this literature review study was to find out the variables that affect the adherence to treatment of type 2 diabetes patients.

2.0 Method

The data source for this literature review research was found using the ScienceDirect database, Google Scholar, Garuda Portal and BMC Public Health. Each article was selected based on inclusion criteria and then critically assessed using the Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA) framework.

A structured literature search was conducted using four electronic databases: ScienceDirect, Google Scholar, the Garuda Portal, and BMC Public Health. The search was carried out on March 17, 2025, employing relevant keywords related to medication adherence among patients with type 2 diabetes mellitus (T2DM). Keyword and inclusion criteria used for Searching terms applied to search articles were based on MESH terms: "Medication Adherence" and "Type 2 Diabetes". To ensure the inclusion of current and relevant studies, the search was limited to full-text articles published between 2020 and 2025. After screening and evaluating the search results, six articles were identified that met the inclusion criteria and aligned with the research focus on factors influencing medication adherence in T2DM patients (Figure 1). These selected studies were then analyzed to extract key findings pertinent to the objective of the review.

The selection criteria for the accepted study met the following criteria: Type 2 diabetic patients; (a) publication of the full text; (b) cross-sectional design; and (c) age factor, (d) gender, (e) education level (f) English language. Meanwhile, exclusion criteria were studies (a) Literature review articles (b) Bahasa language (c) focus on other than DM.

In the initial phase of the literature search, articles were identified using the ScienceDirect database, Google Scholar, Garuda Portal and BMC Public Health. All retrieved articles from these sources were compiled and imported into Mendeley Reference Manager, where duplicate entries were identified and removed. Subsequently, two independent reviewers screened the

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titles and abstracts to assess the relevance of each study. Articles that were review papers, meta-analyses, or those unrelated to the topics of factors Affecting Medication Adherence were excluded. Full-text versions of the remaining articles were then obtained and thoroughly evaluated for eligibility. Studies meeting the inclusion criteria were retained for the final stage: the literature review. Data were extracted from the six articles following the PRISMA guidelines. Including author name, year, location, research design, objectives, sample, research instruments, and findings. All the items were included in data extraction (Table 1).

3.0 Results

Six cross-sectional articles on factors influencing treatment adherence in patients with type 2 diabetes mellitus were identified from four databases based on search results. The main information from the selected publications was grouped, and the data was then analyzed based on the following criteria: author name, year, location, research design, objectives, sample, research instruments, and findings. The results of data extraction are shown in Table 1.

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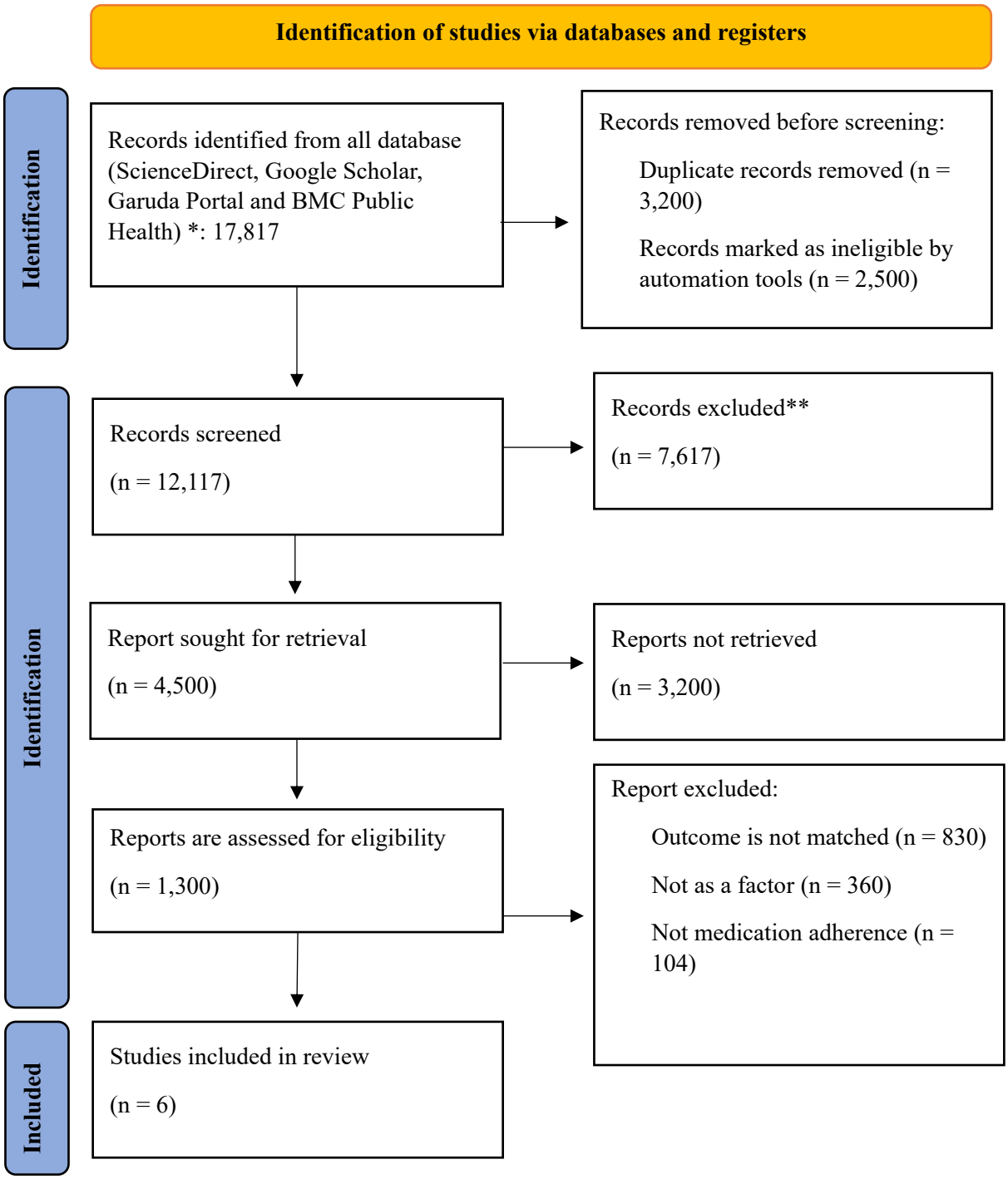

Figure 1. PRISMA flow diagram

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Table 1

Data Extraction Results

No	Author, Year	Place	Design Research	Purpose	Sample	Research instruments	Result
1.	Dalimunthe *et al.* (2023)	Muarasoma Health Center working area, Batang Natal District, Mandailing Natal Regency	Cross-sectional	Analyze the factors that affect adherence to taking antidiabetic medications	77	Data were taken from medical records and data analysis using the Chi-square test.	Adherence to taking antidiabetic medication was obtained in 66.2% of the study subjects, with related factors such as gender, education level, income, knowledge about DM, and family support.
2.	Maymuna *et al.* (2023)	Tamalanrea Health Center, Makassar City, South Sulawesi Province	Cross-sectional	Knowing the factors related to medication adherence in patients with diabetes mellitus at the Tamalanrea Health Center.	207	Questionnaire used in the interview.	There was an association between knowledge ($p<0.05$) and duration of suffering ($p<0.05$) and medication adherence, while there was no association between age, employment status, income, complications, family support, and healthcare worker support.
3.	Shakya *et al.* (2023)	Dhulikhel Hospital, Nepal	Cross-sectional	Identify factors related to adherence to medication use in patients with type 2 diabetes mellitus.	343	Questionnaires and interviews in Nepali, Morisky Medication Adherence Scale 8-item (MMAS-8), Multivariate logistic regression analysis	The results of the study showed that 61% of patients had high adherence. Adherence was higher in patients with formal education (AOR: 2.43), attending diabetes counseling (AOR: 1.76), as well as older age. Women are more obedient than men, while men are more in the low compliance category. The main factors that affect compliance are education, counseling, age, and gender.
4.	Della *et al.* (2023)	Panti Rini Hospital	Cross-sectional	To find out the factors related to treatment adherence in patients with type 2 diabetes mellitus at the Internal Medicine Poly of Panti Rini Hospital.	60	The questionnaire includes demographic data, self-motivation, family support, health worker support, and the Medication Adherence Report Scale (MARS).	Factors that had a significant effect on medication adherence were self-motivation, family support, gender, age, health worker support, and occupation, with self-motivation as the dominant factor (OR 26,488).

5.	Jyotsana *et al.* (2024)	SBKS MI & RC, Sumandeep Vidyapeeth Deemed to be University, Piparia, Vadodara, India and Vardhman Institute of Medical Sciences, Pawapuri, Nalanda, Bihar, India	Cross-sectional	To evaluate self-care practices and the factors that affect them in patients with type 2 diabetes	93	The questionnaire that has been tested, consists of two parts, demographic data and medical history.	The results showed that the prevalence of good self-care practices in type 2 diabetes patients was 37%. In addition, 83.8% of participants followed good monitoring behavior. These factors influencing self-care practices include the patient's knowledge, attitudes, and behaviors in managing their diabetes.
6.	Khardali *et al.* (2024)	Diabetic & Endocrinology Centre of Jazan Hospital, Jazan City, Jazan Province, Saudi Arabia	Cross-sectional	To evaluate patient adherence to the treatment of type 2 diabetes (T2DM) and the factors that affect it.	309	A 31-item self-paced questionnaire that includes demographic, clinical, and GMAS information.	The results showed that patients' adherence to type 2 diabetes (T2DM) treatment was influenced by age, gender, and education. Older patients tend to be more obedient than younger ones ($r = 0.24$; $p < 0.01$) [1]. There was no significant association between sex and obedience, although women may be more obedient [1]. Data on education are not explained in detail, but education is considered to affect understanding of treatment [1]. This study emphasizes the importance of understanding these factors to improve patient compliance.

4.0 Discussion

Several literature reviews have identified key factors influencing medication adherence among patients with type 2 diabetes mellitus. Age has been consistently shown to have a significant association with adherence levels; older adults tend to exhibit lower adherence rates, which may be attributed to the complexity of treatment regimens and age-related cognitive decline. Gender also appears to influence adherence, with some studies reporting that female patients demonstrate higher adherence rates compared to their male counterparts. Furthermore, educational level plays a critical role, as patients with higher educational attainment generally possess better knowledge and understanding of their treatment plans, which positively impacts their adherence behavior. These findings highlight the importance of considering demographic and cognitive factors when designing interventions to improve adherence among diabetic patients.

Adherence to treatment among patients with type 2 diabetes mellitus (T2DM) is influenced by a complex interplay of demographic, social, and psychological factors. Recent studies have highlighted several key determinants of antidiabetic medication adherence. Age is a significant factor; older patients often demonstrate higher adherence rates, likely due to increased awareness of the risks associated with chronic complications (Yosef *et al.,* 2023). Younger patients (<60 years) tend to achieve better glycemic control, as evidenced by improved blood glucose test results, compared to older patients (≥60 years). A statistically significant positive correlation ($r = 0.24$; $p < 0.01$) has been reported between treatment adherence and age groups, indicating differences in adherence behaviors between older and younger patients. A study conducted by Della *et al.* (2023) at the Tamalanrea Health Center in Makassar investigated factors influencing medication adherence among patients with diabetes mellitus. The analysis revealed that only 47% of respondents adhered to their prescribed medication regimen. The primary barrier identified was concern over the potential side effects of the medication. Notably, demographic and social factors such as age, employment status, income, presence of complications, family support, and healthcare provider support showed no significant correlation with medication adherence. In contrast, both patients' knowledge about diabetes ($p = 0.000$) and the duration of illness ($p = 0.000$) were significantly associated with adherence. These findings underscore the critical role of patient education and the length of disease experience in promoting consistent medication use among diabetes patients.

Gender differences also play a role, with some studies indicating that women are more likely than men to adhere to prescribed treatments, possibly due to stronger health-seeking behaviors and social role influences (Alsaidan *et al.,* 2023). Gender differences in self-care behaviors have also been observed; men are generally more consistent in engaging in physical exercise, whereas women demonstrate higher adherence to dietary recommendations. Furthermore, individuals with higher socioeconomic status exhibit greater commitment to exercise routines and foot care practices. Although other studies found that gender and adherence are not statistically significant, some evidence suggests that women may exhibit higher adherence than men (Jyotsana *et al.,* 2024; Khardali *et al.,* 2024).

Educational level and health literacy are additional critical factors; higher education and better health literacy are positively correlated with improved adherence, as they enhance patients' understanding of their condition and the consequences of non-adherence (Zairina *et al.,* 2022). Research indicates a significant relationship between education and medication adherence in diabetes mellitus patients. Studies in Indonesia reveal low adherence levels among diabetic patients, highlighting the need for improved interventions (Pertiwi *et al.,* 2022). Various factors influence adherence, including patient perceptions, drug availability, diabetes education, and demographic characteristics such as age, educational level, and income (Theofilou, 2023). A

randomized clinical trial demonstrated the positive impact of pharmaceutical education on medication adherence and clinical outcomes in patients with Type 2 Diabetes and Systemic Arterial Hypertension. The intervention group showed significant improvements in glycemic control, blood pressure, and lipid profiles, with high adherence rates increasing from 8.7% to 43.5% after six months of pharmacist-led education and support (Contreras-Vergara *et al.,* 2022). These findings underscore the importance of targeted educational interventions in enhancing medication adherence and overall health outcomes for diabetes patients.

Research on medication adherence among diabetes mellitus patients in Indonesia reveals predominantly low adherence levels (Pertiwi *et al.,* 2022). Factors influencing adherence include disease perceptions, drug availability, diabetes education, age, educational level, and religious beliefs (Theofilou, 2023). However, the relationship between education and medication adherence is not consistently significant across studies. A randomized clinical trial demonstrated that pharmaceutical education significantly improved medication adherence and clinical outcomes in patients with Type 2 Diabetes and Systemic Arterial Hypertension (Contreras-Vergara *et al.,* 2022). The intervention group showed increased high adherence rates from 8.7% to 43.5% after six months, along with improvements in glucose levels, blood pressure, and lipid profiles. These findings highlight the complex nature of medication adherence in diabetes management and suggest that targeted educational interventions may be more effective than general educational levels in improving adherence and health outcomes.

Moreover, family and social support have been shown to significantly impact treatment adherence. Patients who receive emotional encouragement and practical assistance from family and peers are more likely to follow their treatment regimens (Pourhabibi *et al.,* 2022b). The duration of the disease and the complexity of the treatment regimen also affect adherence. Patients who have lived with diabetes for a long time and are prescribed complex medication plans such as high doses or multiple drug combinations experience treatment fatigue and concerns about side effects, leading to lower adherence (Yulianti & Anggraini, 2020). Finally, psychological factors, including patients' perceptions of their illness and the perceived efficacy of their treatment, significantly influence adherence behavior. Patients who recognize the severity of their disease and trust in their treatment are more likely to comply with medical recommendations (Gow *et al.,* 2024). Collectively, these findings underscore the multifactorial nature of treatment adherence and the need for personalized, supportive interventions in diabetes care.

T2DM is characterized by relative insulin deficiency resulting from pancreatic beta-cell dysfunction combined with insulin resistance in peripheral target tissues (Widiasari *et al.,* 2021). This dual pathology leads to chronic hyperglycemia, a defining feature of T2DM, caused by impaired insulin secretion and decreased insulin sensitivity (Melytania *et al.,* 2023). The increasing prevalence of T2DM, particularly among individuals of productive age, significantly impairs quality of life. Common symptoms such as numbness, tingling, and frequent urination can disrupt daily functioning and overall well-being (Anggraini *et al.,* 2023). Effective management of T2DM relies on an integrated approach known as the "four pillars" of diabetes care: patient education, medical nutrition therapy, physical exercise, and pharmacotherapy. Adherence to these pillars has been shown to improve glycemic control and enable patients to better manage their blood glucose levels (Sutomo & Purwanto, 2023). This comprehensive management strategy is essential to mitigating the progression of disease and enhancing patients' quality of life.

Non-adherence to prescribed medication in individuals with diabetes can lead to hyperglycemia, primarily due to insufficient insulin production, which impairs the body's ability to convert glucose into energy. Conversely, hypoglycemia may occur in patients who

regularly take antidiabetic medications but fail to adequately monitor their blood glucose levels. Factors such as physical activity, concurrent illnesses, or acute stress can further influence blood glucose fluctuations (American Diabetes Association Professional Practice Committee, 2025). Both hyperglycemia and hypoglycemia pose serious health risks, including increased likelihood of stroke, diabetic coma, and mortality if left unmanaged. Therefore, patient adherence to prescribed treatment regimens is essential for achieving optimal diabetes management. Compliance defined as the extent to which patients follow medical advice and treatment plans is a critical component of effective diabetes care. Through consistent treatment adherence and the adoption of appropriate lifestyle modifications, individuals with diabetes mellitus can maintain glycemic control, improve health outcomes, and sustain a better quality of life (Priyanto *et al.,* 2022).

The effectiveness of DM patients' treatment depends on how well they take anti-diabetic medications. For patients with type 2 diabetes, medication adherence is affected by several factors such as gender, knowledge, and frequency of medication. It is expected that the patient will take the medication as prescribed to avoid difficulties. Complications are usually associated with the prolongation of diabetes mellitus (Jasmine *et al.,* 2020). Brannon *et al.* (2013) in Sovia *et al.,* (2024) stated that patient adherence to treatment is influenced by the severity of the disease, the nature of treatment, and personal factors.

Multiple studies have demonstrated that medication adherence among patients with T2DM is influenced by demographic and psychosocial factors such as age, gender, education, income, and family support. Low health literacy, which impairs patients' understanding of their condition and treatment, has been consistently associated with poorer health outcomes and reduced adherence (Shiomi *et al.,* 2021). Recent research by Dalimunthe *et al.* (2023), Maymuna *et al.* (2023), and Shakya *et al.* (2023) highlights that formal education and awareness about diabetes significantly enhance adherence to antidiabetic medications. Specifically, patients with higher educational attainment demonstrate better adherence, likely due to increased comprehension of disease management. Additionally, older patients tend to follow prescribed medication regimens more consistently than younger individuals. Gender differences have also been observed, with women generally showing higher adherence rates compared to men, who are more frequently classified in the low-adherence group. Other factors such as occupation, self-motivation, family support, and encouragement from healthcare providers further contribute to adherence behavior. For example, studies involving T2DM patients reported that more than half of the respondents were female, under 60 years of age, and had completed high school, suggesting that these demographic characteristics are correlated with medication adherence. Collectively, these findings underscore the multifactorial nature of adherence and the importance of targeted interventions to address these determinants.

Based on the results of the research that has been reviewed, medication adherence in patients with type 2 diabetes mellitus is influenced by various demographic and social factors. Age, gender and education factors have an important role in terms of compliance in consuming type 2 diabetes mellitus medication.

5.0 Conclusion and Recommendation

Age, gender, and education all have an impact on medication adherence in type 2 diabetes mellitus patients. Highly educated patients who attend diabetes counseling are usually more compliant. Although older patients are typically more cooperative with their medications, some may experience difficulties due to cognitive impairment or the complexity of their prescription

regimens. Compared to men, who are more likely to fall into the category of poor compliance, women are more obedient.

Better health education is needed, especially for patients with low levels of education and elderly patients who have difficulty understanding the treatment schedule. To provide broader support to older patients with cognitive impairment, diabetes counseling services should be expanded. In addition, a more targeted approach should be used to improve adherence in younger age groups and men, who have lower levels of adherence. Involving family members and medical experts is essential to guarantee that patients are taking medication as prescribed.

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