

# A Review on Knowledge of Diabetes, Medication Adherence, and Factors associated with Non-adherence among Diabetes Mellitus Type 2 Patients

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## ABSTRACT

**Background:** This review paper addresses the critical issue of medication adherence among patients with Diabetes Mellitus Type 2 (T2DM). This review paper aims to evaluate the current literature on prevalence of medication adherence among patients with T2DM, assesses the level of knowledge regarding diabetes mellitus and its association with medication adherence. In addition, to identify and analyse the factors contributing to non-adherence to medication among individuals with T2DM.

**Methods:** The authors conducted a thorough literature review using databases such as ProQuest, PubMed, ScienceDirect, and Google Scholar. They focused on peer-reviewed articles published between 2019 and 2024, employing keywords related to medication adherence, knowledge, and sociodemographic factors. A total 25 studies selected for inclusion, utilizing various methodologies including quantitative, qualitative, and interventional approaches.

**Results:** The findings revealed significant variability in medication adherence rates among T2DM patients, ranging from 35.8% to 67.5%. Key factors influencing adherence included sociodemographic characteristics such as age, gender, ethnicity, education level, and economic status. Higher levels of diabetes knowledge were associated with better adherence, although the relationship was not universally significant, indicating that other factors also play a role.

**Conclusion:** The review concludes that enhancing medication adherence among T2DM patients requires targeted interventions that address identified barriers, including educational deficits and socioeconomic challenges. Further research is recommended to develop effective educational strategies tailored to diverse patient populations, ultimately aiming to improve health outcomes and adherence rates in this critical area of public health.

**Keywords:** Medication adherence; Diabetes Mellitus Type 2; Non-adherence factors; Sociodemographic characteristics; Patient education; Healthcare interventions

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## INTRODUCTION

Diabetes Mellitus Type 2 (T2DM) is a chronic illness that poses significant global health challenges. Malaysia has one of the highest rates of diabetes in the world and the highest in the Western Pacific area (1). With rising prevalence rates, T2DM has emerged as a major public health concern. A crucial factor in managing and preventing the complications of T2DM is adherence to prescribed medications. However, medication non-adherence remains a substantial barrier to achieving optimal diabetes control, leading to unfavourable clinical outcomes and increased healthcare costs. For instance, in Malaysia, studies have shown fluctuating rates of medication adherence among T2DM patients. A 2021 study reported that approximately 60.3% of Malaysian T2DM patients were adherent to their prescribed medications (2). The observed non-adherence is concerning given the rapidly increasing prevalence of diabetes in the country and underscores the urgent need for targeted interventions to support medication adherence in this population.

Factors contributing to non-adherence in diabetic patients can range from psychosocial aspects, such as beliefs about illness and medication, to economic constraints, the complexity of medication regimens, and side effects of medications (3). There are several factors associated with non-adherence to medication among T2DM patients as indicated in the previous studies and official reports. The World Health Organization (WHO) suggested five categories of adherence-related factors that could be targeted in interventions to improve adherence: (i) condition-related, (ii) therapy-related, (iii) socioeconomic-related, (iv) healthcare and system-related and (v) patient-related factors (4,5).

However, for this study, the researcher only will be focusing on selected sociodemographic (patient-related factors) characteristics,

socioeconomic factors and condition-related factors which are age, gender, ethnicity, education level, number of medication intake, household income, presence of comorbidities, and duration of T2DM. These factors are chosen based on their significant influence on medication adherence. Age and gender can affect patients' attitudes towards medication and their ability to manage their treatment regimen (6). Ethnicity and education level are important as they can influence health literacy and cultural beliefs about medication (7). The number of medications taken can impact adherence due to the complexity of the regimen (8). Household income is a critical factor as it affects the ability to afford medications. The presence of comorbidities can complicate treatment and adherence due to the added burden of managing multiple conditions (9). Lastly, the duration of T2DM is relevant because long-term patients might experience burnout or become more adept at managing their condition, impacting adherence differently over time (10). Enhancing adherence among diabetic patients requires a comprehensive understanding of these barriers and tailored interventions to address them.

This review aims to achieve three main objectives. First, it evaluates the current literature on prevalence of medication adherence among patients with T2DM. Second, it assesses the level of knowledge regarding diabetes mellitus and its association with medication adherence in these patients. Third, it identifies and analyses the factors contributing to non-adherence to medication among individuals with T2DM.

## METHODS

In this research, the resources were obtained from the databases available online which are ProQuest, PubMed, ScienceDirect, and Google Scholar which are subscribed in the IIUM library online database. The items searched are scholarly articles and journals related to support the topic of research.

**Table 1:** Keywords of search strategies

| Keyword |                          | Alternate Term |                          | Alternate Term          |
|---------|--------------------------|----------------|--------------------------|-------------------------|
|         | Medication adherence     | OR             | Medication compliance    | OR Medication Obedience |
| AND     | Knowledge                | OR             | Awareness                | OR Comprehension        |
| AND     | Sociodemographic factors | OR             | Demographic factors      | OR Sociological factors |
| AND     | Diabetes Mellitus        | OR             | Diabetes Mellitus Type 2 | OR Insulin resistant    |

### Inclusion & Exclusion Criteria

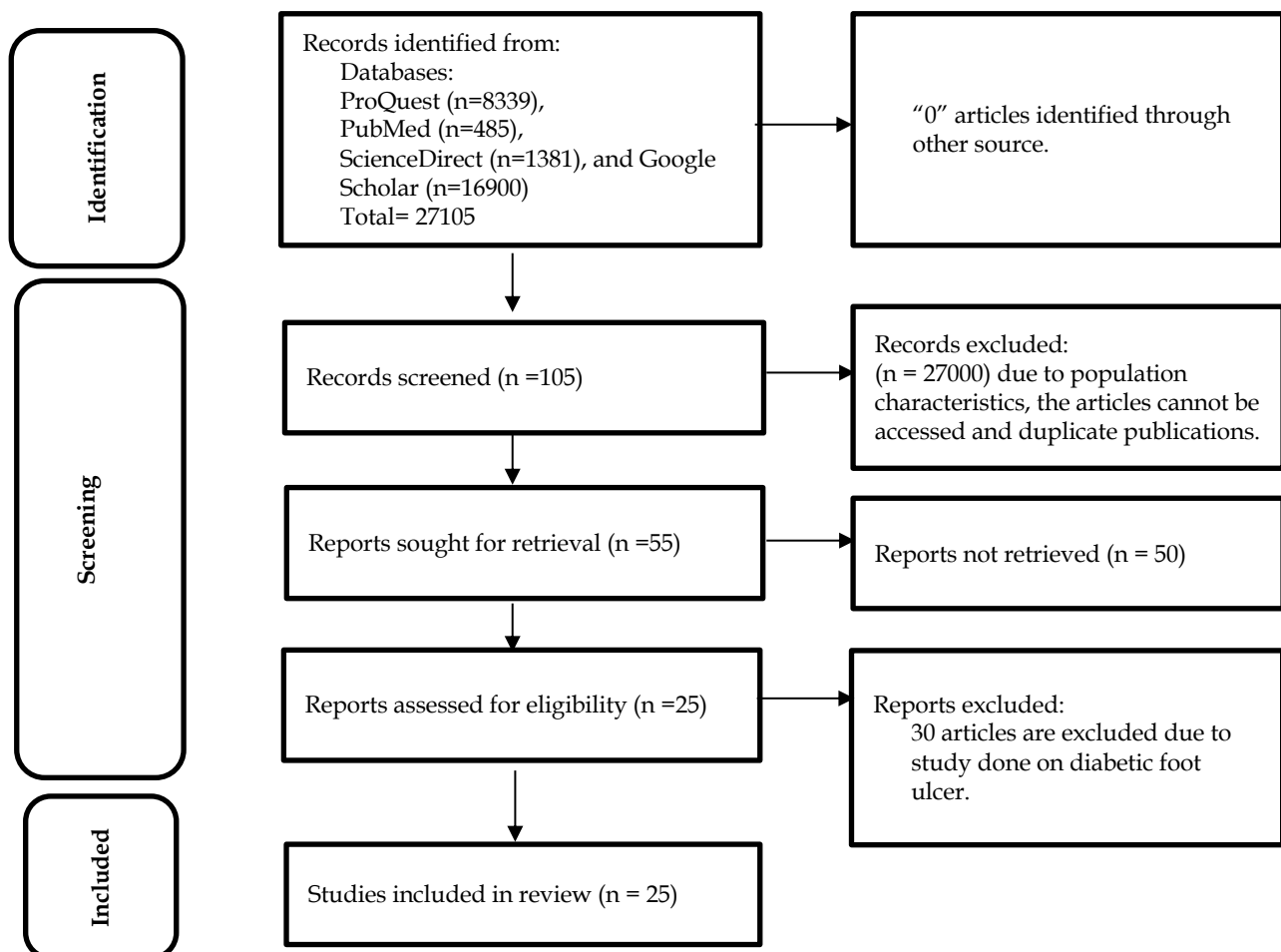
The articles searched were guided by filters which enable the researchers to sort out the selected ones based on the fixed criteria and to evaluate the current base evidence using Advanced Search. The resources were filtered by format or type of sources, language, subject, and date of availability. The researcher has limited the source type to articles and scholarly journals. The language chosen was English. The researchers set the date of resources to availability to five years back that was from the year of 2019 to 2023. If insufficient information was presented in the title and abstract, the full paper was retrieved for further consideration.

The keywords used in the search were specified using Boolean operators (**Table 1**). The researcher used the “AND” to narrow down the search topic. The researcher mostly used the location of the availability of the keywords anywhere including document title, document text, and abstract. The keywords used in the search strategy were

medication adherence, knowledge, and sociodemographic factors.

Although this study does not aim to conduct a systematic review, a critical appraisal and assessment of the included articles were performed using the Critical Appraisal Skills Programme (CASP) tool. A systematic review involves a comprehensive and structured approach to identifying, evaluating, and synthesizing all relevant studies on a specific topic, following a predefined protocol. In contrast, the CASP tool provides a structured checklist to critically appraise individual studies' quality and relevance, focusing on specific aspects such as study design, methodology, and validity. The CASP tool was selected for this review because it allows for a rigorous assessment of the methodological quality of the included studies, ensuring that the findings are based on reliable and valid evidence, without the extensive resources and time commitment required for a full systematic review.

**Figure 1:** PRISMA flow diagram



## FINDINGS

A total of 27105 articles were found through the initial literature search, as depicted in **Figure 1**. Of the 25 articles that are featured, 22 employed quantitative methods, two used qualitative methods and one used interventional method, as shown in **Table 2**. The inclusion criteria for selecting these studies were: (1) articles published in peer-reviewed journals, (2) studies involving

patients with T2DM, (3) studies that measured medication adherence using validated scales or methods such as the Morisky Medication Adherence Scale (MMAS), and (4) studies published in English. One study used an interventional method to evaluate the effectiveness of an intervention aimed at improving medication adherence among T2DM patients. The studies' sample sizes varied from 17 to 884.

**Table 2:** Literature findings

| AUTHOR/<br>PUBLICATION<br>YEAR | TYPE/METHOD                               | SAMPLE SIZE/<br>SAMPLING                   | INSTRUMENT                                                            | FINDINGS/ RESULT                                                                                                                                                                                                |
|--------------------------------|-------------------------------------------|--------------------------------------------|-----------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Eze et al., 2022               | Quantitative,<br>cross-sectional<br>study | N=200                                      | Questionnaires                                                        | The results showed patients mostly had poor glycaemic control and moderate adherence was predominant in the population.                                                                                         |
| AlQarni et al., 2019           | Quantitative,<br>cross-sectional<br>study | N=212                                      | General Medication Adherence Scale (GMAS)                             | The study highlighted that medication adherence is influenced by religious and social factors. 35.8% had high adherence to anti diabetic medications.                                                           |
| Hrushikesh et al., 2023        | Quantitative,<br>cross-sectional<br>study | N=101                                      | Medication Adherence Rating Scale (MARS)                              | 72% of T2DM patents adhered to the prescribed medications. However, in patients with multiple drugs prescription, it showed poor medication adherence.                                                          |
| Horii et al., 2019             | Quantitative,<br>retrospective<br>study   | N=884                                      | Questionnaire                                                         | The condition of polypharmacy reportedly leads to various complications and is believed that medication adherence is higher in patients with polypharmacy compared to those with a small number of medications. |
| Chin et al., 2023              | Quantitative,<br>cross-sectional<br>study | N=386,<br>systematic<br>random<br>sampling | 7-item structured questionnaire, HbA1c test and medical record review | Approximately 60.3% of the participants were adherent to their medication, and in increasing age was significantly associated with medication nonadherence. Malay ethnicities were associated with poor         |

| AUTHOR/<br>PUBLICATION<br>YEAR | TYPE/METHOD                               | SAMPLE SIZE/<br>SAMPLING                 | INSTRUMENT                                                                                                     | FINDINGS/ RESULT                                                                                                                                                                                                                    |
|--------------------------------|-------------------------------------------|------------------------------------------|----------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                |                                           |                                          |                                                                                                                | glycaemic control.                                                                                                                                                                                                                  |
| Atolagbe et al.,<br>2023       | Interventional<br>study                   | N=380, snowball<br>sampling<br>technique | Questionnaire                                                                                                  | Both control and intervention groups forget to take their medications and had low adherence scores. However, the adherence level among the intervention groups had a significant improvement during the period of intervention.     |
| Buksh et al., 2019             | Quantitative,<br>cross-sectional<br>study | N=218                                    | Diabetes<br>Knowledge<br>Questionnaire<br>(DKQ) and<br>Diabetes Self-<br>Management<br>Questionnaire<br>(DSMQ) | Disease knowledge significantly correlated with glycaemic control. More knowledgeable someone regarding his condition, more adherence to medication.                                                                                |
| Jamaludin et al.,<br>2020      | Quantitative,<br>cross-sectional<br>study | N=220                                    | Questionnaire                                                                                                  | The participants who have high knowledge may have good practice toward medication adherence. It was reported that female patients had a higher level of knowledge compared to male patients.                                        |
| Islam et al., 2021.            | Quantitative,<br>cross-sectional<br>study | N=500                                    | 8-item Morisky<br>Medication<br>Adherence Scale                                                                | Almost half of the patients had suboptimal medication adherence. Low medication adherence was significantly increasing among younger people.                                                                                        |
| Madae'en et al.,<br>2020       | Quantitative,<br>cross-sectional<br>study | N=521                                    | Michigan<br>Diabetes<br>Knowledge and<br>Morisky<br>Medication<br>Adherence Scale                              | The data of study showed a moderate level of diabetes knowledge among study participants and low adherences scores to diabetes medications, with no correlations between variables of the study and the sociodemographic variables. |
| Masrurroh et al.,<br>2021      | Quantitative,<br>cross-sectional<br>study | N=48, simple<br>random<br>sampling       | Questionnaire                                                                                                  | No relationship between the variable level of knowledge and medication adherence. Majority of respondents had a lack of knowledge                                                                                                   |

| AUTHOR/<br>PUBLICATION<br>YEAR  | TYPE/METHOD                               | SAMPLE SIZE/<br>SAMPLING          | INSTRUMENT                                         | FINDINGS/ RESULT                                                                                                                                                                                                                                            |
|---------------------------------|-------------------------------------------|-----------------------------------|----------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Ishaq et al., 2021              | Quantitative,<br>cross-sectional<br>study | N=300                             | Questionnaire                                      | The result showed participants still lack knowledge of T2DM. Moderate adherence was reported.                                                                                                                                                               |
| Abdullah et al., 2019           | Quantitative,<br>cross-sectional<br>study | N=232                             | Medication<br>Compliance<br>Questionnaire          | The overall percentage of medication adherence among patients with DM was 55.2%. Malay had 1.43 times higher odds of nonadherent to medication than Chinese and Indian patients.                                                                            |
| Nasruddin et al., 2021          | Quantitative,<br>cross-sectional<br>study | N=249                             | Questionnaire                                      | The adherence to insulin therapy in primary health centres in Malaysia was very poor.                                                                                                                                                                       |
| Sah, Gaire & Basyal, 2021       | Quantitative,<br>cross-sectional<br>study | N=175                             | Morisky<br>Medication<br>Adherence Scale<br>(MMAS) | The level of adherence to diabetes medication was unsatisfactory. Predictors to non-adherence were age group, education, employment, income, duration of disease, and diabetic complications.                                                               |
| Abate, 2019                     | Quantitative,<br>cross-sectional<br>study | N=416                             | Morisky<br>Medication<br>Adherence Scale<br>(MMAS) | The older participants, the more adherent they are to medication.                                                                                                                                                                                           |
| Dhillon, Nordin & Ramadas, 2019 | Quantitative,<br>cross-sectional<br>study | N=150                             | Morisky<br>Medication<br>Adherence Scale<br>(MMAS) | Sociodemographic factors were not associated with medication adherence. However, socioeconomic factors do affect the medication adherence, this may due to various factors including affordable healthcare services and a lower cost of living in Malaysia. |
| Mamo et al., 2019               | Quantitative,<br>case-control<br>study    | N=410,<br>consecutive<br>sampling | Questionnaire                                      | The determinants of poor glycaemic control were comorbidities, diabetes duration of greater than 7 years.                                                                                                                                                   |
| Mahmoodi et al., 2019           | Quantitative,<br>cross-sectional<br>study | N=455, random<br>sampling method  | Questionnaires                                     | 54.5% of study participants reported low drug adherence. The study revealed that women were constantly less likely than men to be adherent.                                                                                                                 |

| AUTHOR/<br>PUBLICATION<br>YEAR | TYPE/METHOD                                                  | SAMPLE SIZE/<br>SAMPLING | INSTRUMENT                                                                    | FINDINGS/ RESULT                                                                                                                                                                                                           |
|--------------------------------|--------------------------------------------------------------|--------------------------|-------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Abdullah et al., 2020          | Qualitative, in-depth interviews and focus group discussions | N=24                     | Thematic analysis                                                             | This study discovered a disparity in the health literacy experiences of multiethnic patients with T2DM.                                                                                                                    |
| Ayele et al., 2019             | Quantitative, cross-sectional study                          | N=275                    | Morisky Medication Adherence Scale                                            | Complex medication regimens may have a greater impact on nonadherence than the total amount of medications consumed.                                                                                                       |
| Pati et al., 2021              | Qualitative, in-depth interview                              | N=17                     | Thematic analysis                                                             | Household income is an important element in determining the ability to purchase medication. Comorbidities can make treatment and adherence more difficult because addressing several disorders contributes to the fatigue. |
| Jannoo & Khan, 2019            | Quantitative                                                 | N=497                    | Morisky Medication Adherence Scale & Summary of Diabetes Self-Care Activities | The duration of T2DM is important because long-term patients may develop burnout or grow more proficient at managing their disease, affecting adherence differentially over time.                                          |
| Lee et al, 2020                | Quantitative, cross-sectional study                          | N=196                    | The Literacy Assessment for Diabetes and Diabetes Knowledge Test 2            | This study revealed only 3.6% of the 196 participants had a strong understanding of diabetes                                                                                                                               |
| Sendekie et al., 2022          | Quantitative, cross-sectional study                          | N=403                    | General Medication Adherence Scale (GMAS)                                     | A variety of medical illnesses and medication were discovered to relate to medication adherence.                                                                                                                           |

### Adherence to Medication

Various studies have been done over the past decades regarding medication adherence among diabetes patients. A study done in Nigeria reported moderate adherence to medication with a prevalence of 54.5% (11). In another study that was conducted in Saudi Arabia, most of the patients had unsatisfactory levels of medication adherence to anti-diabetic medicines with 35.8%. This finding is related to the health statistics of the Ministry of Health, Kingdom of Saudi Arabia as it reported a high prevalence of diabetes mellitus among adult

patients but only a third of them had adhered to their anti-diabetic medications (12).

Apart from this, a study by Horii et al. (2019) stated that 49.8% of participants were adherent, thus about half were non-adherent to medication (13). Another study in Bangladesh showed that 42.8% of the participants had poor medication adherence (14). In Malaysia, a study revealed that 60.3% of the participants had good medication adherence, aligned with the average adherence rate of patients in Malaysia who have diabetes mellitus and with previously

documented suboptimal adherence rates between 40% and 60% (2).

In the meantime, an intervention study carried out in the Klang Valley, Malaysia, with diabetes patients revealed that most of the participants in both the control and intervention groups had poor adherence scores and frequently neglected to take their medications with an adherence rate of 53.08% to 85.12% (15). This study involved an educational intervention designed to improve adherence among T2DM patients. Participants were divided into control and intervention groups. The intervention group received additional education and support on managing diabetes and the importance of medication adherence, while the control group received standard care. The authors noted that diabetes patients' adherence to prescription medication was 67.5% lower compared to patients with other medical conditions. This study highlights the challenges of medication adherence among diabetes patients in Malaysia, particularly in the Klang Valley, a densely populated and diverse region. It underscores the need for more effective interventions and support systems to improve adherence rates, which are crucial for achieving better health outcomes and managing diabetes more effectively (15). In addition, Abdullah et al. (2019) discovered that the overall percentage of medication adherence among diabetes mellitus in Selangor, Malaysia was 55.2% (12). An adherence rate below 80% is often considered suboptimal or low because it suggests that patients are missing doses or not following their medication regimen consistently (16). Therefore, the 55.2% adherence rate observed in this study is considered low, highlighting significant challenges in medication adherence among diabetes patients in Selangor (17).

### **Patient's Level of Knowledge Regarding Diabetes Mellitus Type 2**

Patients will adhere to medication more when they have more knowledge regarding their disease, as in this study, T2DM. This was proved by an educational intervention study held in Klang Valley, Malaysia. The study's findings demonstrated that compared to the control group, the majority of respondents' medication adherence was significantly improved in the intervention group. This is a result of the online educational material provided to the intervention group to help them understand their condition better. While this study is one of the few randomized controlled trials (RCTs) in Malaysia focusing on educational interventions for diabetes patients, it highlights the

potential benefits of such interventions. Further research is needed to corroborate these findings and explore other educational strategies to improve medication adherence among diabetes patients in Malaysia (15). Another study conducted at government primary care clinic in Seremban, Malaysia revealed that only 3.6% of the 196 participants had a strong understanding of diabetes (18).

According to Buksh et al., knowledge of diabetes was strongly correlated with having optimal glycaemic control (19). Research revealed that 64.5% of the participants demonstrated a strong understanding and effective practices regarding medication adherence (20). Similarly, a study by Ishaq et al. also reported that there was an association between disease-related knowledge and medication compliance (21). This proved that patients who have more knowledge of diabetes will adhere more to medication then leads to good glycaemic control.

In one study, it was reported that most participants have a moderate level of diabetes knowledge and low adherence to antidiabetic medication. In the same study, patients under the age of 45 had the highest level of knowledge with the highest adherence score compared to other groups of age (22). Moreover, a study did not find a statistically significant association between patients' knowledge levels about their disease (specifically type 2 diabetes mellitus) and their adherence to medication. This implies that factors other than knowledge alone may influence medication adherence among patients with diabetes (23). In addition, from their study, most of the participants had a low level of knowledge regarding diabetes, which also discovered by previous study that found that their respondents lacked knowledge of type 2 diabetes mellitus (21).

In short, there is a need to evaluate the effectiveness of educational programs in improving patients' understanding of diabetes and its management. Understanding the level of knowledge and its impact on adherence can guide the development of targeted educational interventions (22).

### **Factors Associated with Non-Adherence to Medication**

There are several factors associated with non-adherence to medication among diabetic patients as reported in the literature. The researcher focuses on selected

sociodemographic (patient-related factors), socioeconomic-factors and condition-related factors which are age, gender, ethnicity, educational level, and number of medications intake daily, household income, presence of comorbidities, duration of T2DM.

### *Age*

In terms of age, many studies suggest that younger people tend to be more non-adherent to medication. This is proved by studies conducted in Saudi (12), Japan (13) and Northwest Ethiopia (24) that stated that medication adherence correlated positively with patient age as their findings suggest that patients tended to be more adherent with increasing age. Moreover, knowledge of adherence may rise because of older people having more pharmaceutical therapy experience compared to younger age (12). These statements are also supported by previous study when they associate older people with adherence to medication due to regular visits giving doctors and pharmacists the chance to reassess medications concerning the patient's current health (13). Apart from this, one article that studies medication adherence in elderly diabetic patients showed that 72% of T2DM adhered to the prescribed medications which is higher than other studies (25). In contrast to earlier findings, Chin et al.'s research from 2023 revealed a startling conclusion that older patients were more likely to be nonadherent than younger ones and have poor glycaemic control (2).

### *Gender*

When compared to male, female was found as significantly associated with non-adherence to medication. Similarly, studies done reported that in this domain of adherence, most male patients had slightly better adherence scores compared to females (12,26). Furthermore, similar results were indicated in a study done in Pakistan with the self-care practices for glycaemic control in the female group being lower than male (19). Nevertheless, previous study discovered that, when compared to male patients, female patients had a better degree of knowledge about medication adherence, with a statistically significant association (20). Besides, there was no statistically significant difference between men and women in terms of low, medium, or high medication adherence reported in a study conducted in Bangladesh (14). This result was same as one study conducted in Malaysia that showed sociodemographic has no significant association with medication adherence (2). Thus, further study needs to be conducted to discover the association of gender with medication adherence to antidiabetic

medication.

### *Ethnicity*

In terms of ethnicity, a study found that Malay patients had a 1.43 times higher prevalence of non-adherence to medications than Chinese and Indian patients (17). Similarly, a study among 386 T2DM patients in Johor, Malaysia found that Malays had the highest number of non-adherent patients, with 118 Malay patients not adhering to their medication regimens (2,17). Thus, this concludes that the Malay ethnicity had poor glycaemic control and low medication adherence. However, Malay ethnicity in one study was reported to be more adherent than other ethnicities (26). This may be due to every ethnicity having its own beliefs and cultures that may influence their perception of health and treatment options. For example, one possible explanation for the lower drug adherence among Malay patients could be their cultural beliefs on traditional Malay treatment (17).

### *Educational Level*

According to studies done in a tertiary care hospital, participants with lower education reported not adhering to medication compared to educated participants (20,25). This shows that education level influences medication adherence. A similar result showed that patients with university-level scored better on the Diabetes Knowledge Questionnaire sum scale compared to those with no formal education, primary level, and secondary level of education (19). On the other hand, a study conducted in Saudi Arabia, Malaysia and Bangladesh stated patients' educational background had no impact on drug adherence (2,12,14).

### *Number of Medications Intake Daily*

The increased number of medications prescribed was significantly associated with non-adherence among patients as reported in studies conducted in India and Bangladesh (14,25). Higher daily intake of medications can negatively influence the patient's perception towards medication, which later may reduce their adherence to the medication as stated in one study that reported "a quarter of patients had partial-to-poor adherence specifically due to comorbidity and pill burden" (12). This may be due to concerns about side effects and long-term adverse effects of polypharmacy. Contrary to other studies, a study showed that adherence was correlated with older age and polypharmacy (13). Besides,

one study stated that there was no correlation between patients receiving single or multiple therapies and their adherence score (22).

#### *Household Income*

Patients who earned less each month were more likely to non-adherence with their prescribed medications (27). This supported by previous study that stated "the greater one's income, the lower one's likelihood of non-adherence to medications" (24). On the other hand, in one study conducted in Malaysia stated that income was not associated with medication adherence. The differences could be caused by lots of things, such as Malaysia's lower cost of living and easy access to healthcare (28).

#### *Presence of Comorbidities*

Previous studies revealed that the presence of DM-related comorbidities did not significantly affect adherence to antidiabetic medication (26 & 14). Besides, a study found that presence of comorbidity was significantly associated with poorer glycaemic control, thus this showed poor medication adherence among patients with comorbidities (29). The current study found that inadequate medication adherence was substantially associated with poor glycaemic control. Several medical illnesses and medicines were discovered to be related to medication adherence. Management approaches for T2DM patients with comorbidities should focus on improving adherence to medications (30).

#### *Duration of T2DM*

A study showed that, compared to people with diabetes mellitus for less than five years, study participants with diabetes mellitus for more than ten years had a 45-fold higher likelihood of medication non-adherence (27). Early in the disease process, patients are more committed to managing their condition, but as the disease worsens and they become more burdened and this commitment in taking medication decreases (27). In addition, a study supported the prior statement as the longer duration of diabetes were poorer glycaemic control (29).

Thus, this means that the longer duration of T2DM, the less adherence to antidiabetic medication. Nevertheless, studies found that the duration of DM had no association with adherence to antidiabetic therapy (19,26). This contradicts with previous study that a longer duration of diabetes and its management was linked to a greater

understanding towards diabetes and lead to more adherence to medication (20).

## **DISCUSSION**

As diabetes continues to be a significant global health challenge, exploring the interplay between patient knowledge and adherence behaviors is essential for developing effective interventions. Adherence rates vary significantly across different populations, with some studies reporting adherence as low as 55.2% (17), while others find rates closer to 80% (25). One possible explanation for these variation results is a difference in medication adherence measurement methods.

The literature consistently indicates that a higher level of knowledge regarding diabetes correlates with improved medication adherence. For instance, an educational intervention study conducted in Klang Valley, Malaysia, demonstrated that participants who received targeted educational materials exhibited significantly better adherence compared to a control group (15). This suggests that enhancing patient knowledge through structured educational programs can lead to more effective self-management of diabetes, thereby improving medication adherence and glycaemic control.

However, the relationship between knowledge and adherence is not universally straightforward. Some studies, found no statistically significant association between knowledge levels and adherence, implying that other factors might also play a critical role in influencing adherence behaviours (23). This highlights the necessity for a comprehensive approach that considers various determinants of adherence, beyond just patient education.

Sociodemographic factors significantly influence medication adherence among T2DM patients. Age is a prominent factor, with many studies indicating that older patients tend to adhere better to their medication regimens. This may be attributed to their greater experience with managing chronic conditions and regular interactions with healthcare providers, which facilitate medication management (13). Conversely, some recent findings suggest that older patients may also experience challenges that lead to non-adherence, such as polypharmacy and cognitive decline, indicating the need for tailored interventions that address the specific needs of older adults (2).

Gender differences in adherence have also been noted, with studies indicating that males often demonstrate better adherence than females. This disparity could be linked to differences in health literacy, social support, and cultural beliefs regarding health management (12,26). Further research is needed to explore these gender dynamics and their implications for adherence.

Educational attainment is another critical factor influencing medication adherence. Patients with higher educational levels typically exhibit better adherence due to a greater understanding of their condition and treatment options (20,25). However, some studies have reported no significant impact of educational background on adherence, suggesting that other contextual factors, such as access to healthcare resources, may mitigate these effects (2,12,14).

In addition, the complexity of medication regimens, characterized by polypharmacy, has been consistently associated with non-adherence (14,25). As the number of medications increases, patients may feel overwhelmed, leading to confusion and decreased adherence (12). This underscores the importance of simplifying medication regimens where possible and providing clear instructions to enhance adherence.

Moreover, for socioeconomic status, particularly household income has been linked to medication adherence. Lower-income patients often face financial barriers that hinder their ability to afford medications, leading to non-adherence (27). However, some studies in Malaysia have indicated that income may not significantly impact adherence, potentially due to the country's lower cost of living and access to healthcare services (28). This suggests that socioeconomic factors are complex and may vary across different contexts.

Next, the presence of comorbidities can complicate medication adherence. While some studies indicate that comorbidities do not significantly affect adherence (14,26), they are often associated with poorer glycaemic control, suggesting an indirect impact on adherence behaviours (29). Additionally, the duration of diabetes has been shown to influence adherence, with longer durations often leading to decreased adherence as patients may become fatigued by the chronic management of their condition (27).

In summary, the interplay between knowledge of diabetes, medication adherence, and the various factors influencing non-adherence is complex and multifaceted. While increased knowledge about

diabetes is crucial for improving adherence, it is evident that sociodemographic, socioeconomic, and health-related factors also play significant roles. Future research should focus on developing and evaluating targeted educational interventions that address these diverse influences, ultimately aiming to enhance medication adherence and improve health outcomes for patients with T2DM. Understanding these dynamics will be essential for healthcare providers in designing effective strategies to support patients in their diabetes management journey.

## CONCLUSION

In conclusion, the evidence presented in this review indicates that knowledge about diabetes significantly impacts medication adherence among T2DM patients. Educational interventions have shown promise in enhancing patient understanding, which in turn can lead to better adherence and improved glycaemic control. However, the relationship between knowledge and adherence is complex, as various sociodemographic, socioeconomic, and health-related factors also play critical roles. Factors such as age, gender, ethnicity, educational level, medication complexity, and the presence of comorbidities all contribute to the adherence landscape, indicating that a multifaceted approach is necessary for effective management of T2DM.

## RECOMMENDATIONS

In order to improve medication adherence among T2DM patients, health care providers can implement structured educational interventions tailored to the specific needs of diverse patient populations. These programs should focus on increasing diabetes knowledge and addressing common misconceptions, particularly among groups with lower adherence rates.

Next, healthcare providers can develop personalized care plans that consider the unique sociodemographic and health-related factors influencing each patient's adherence. This may involve simplifying medication regimens and providing support for managing comorbidities.

Other than that, foster cultural competence among healthcare providers to understand and address the beliefs and practices of different ethnic groups. This can help in creating more effective communication strategies and adherence interventions. Next, establish regular

follow-up mechanisms to monitor medication adherence and provide ongoing support. This could involve the use of technology, such as mobile health applications, to remind patients of their medication schedules and provide educational resources.

Lastly, encourage further research to explore the multifactorial nature of non-adherence, particularly in different cultural and socioeconomic contexts. Understanding these dynamics can lead to more effective strategies for improving adherence.

## IMPLICATIONS

The implications of this review are significant for healthcare providers, policymakers, and researchers. By recognizing the critical role of patient knowledge and the various factors influencing medication adherence, healthcare systems can implement more effective strategies to support T2DM patients. Improving adherence not only enhances individual health outcomes but also reduces the overall burden of diabetes on healthcare systems.

Ultimately, a comprehensive approach that integrates education, personalized care, and ongoing support will be essential in addressing the challenges of medication adherence among individuals with T2DM. By fostering a better understanding of diabetes and its management, we can empower patients to take an active role in their health, leading to improved adherence and better health outcomes.

## CONFLICT OF INTEREST

The authors declare no conflicts of interest related to this study.

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## AUTHOR CONTRIBUTIONS

**NMAS, MAIR, NYAH:** drafted the manuscript and contributes to the concept development and design of the article through data collection, analysis and

data interpretation for the article.

**NAM:** revised the manuscript critically with intellectual contents and approved the final version of the manuscript.

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