

Original Research Article

Determinants and patterns of medication adherence among individuals with type 2 diabetes mellitus

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Received: 16 July 2026

Revised: 03 September 2026

Accepted: 09 September 2026

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ABSTRACT

Background: Medication adherence is a key determinant in the effective management of type 2 diabetes mellitus (T2DM). Poor adherence contributes to inadequate glycemic control, increased complications, and higher healthcare costs. This study aimed to assess patterns of medication adherence and associated factors among patients with T2DM in Bangladesh.

Methods: A facility-based cross-sectional study was conducted among 412 adult patients with T2DM attending selected hospitals in Gazipur and Manikganj districts from September 2024 to March 2025. Participants were selected using simple random sampling. Data were collected through face-to-face interviews using a structured questionnaire, including the validated 8-item Morisky Medication Adherence Scale (MMAS-8). Descriptive statistics, Chi-square tests, and multivariable logistic regression analyses were performed using SPSS version 26.

Results: Overall, 31.6% of participants demonstrated high adherence, 38.8% medium adherence, and 29.6% low adherence. Higher adherence was significantly associated with secondary or higher education (AOR: 2.14; 95% CI: 1.32-3.46), shorter duration of diabetes (<5 years) (AOR: 1.78; 95% CI: 1.10-2.89), good healthcare access (AOR: 2.67; 95% CI: 1.59-4.49), and living with family. Polypharmacy (AOR: 0.56; 95% CI: 0.34-0.91) and comorbidities (AOR: 0.63; 95% CI: 0.40-0.98) were negatively associated. Common barriers included forgetfulness (48.2%), financial constraints (33.5%), and lack of awareness (27.9%).

Conclusions: Medication adherence among patients with T2DM was moderate and influenced by multiple factors. Interventions focusing on patient education, improved healthcare access, and family support are essential to enhance adherence and improve outcomes in Bangladesh.

Keywords: Bangladesh, Healthcare access, Medication adherence, MMAS-8, Polypharmacy, Type 2 diabetes mellitus

INTRODUCTION

Diabetes mellitus, particularly type 2 diabetes mellitus (T2DM), is a swiftly growing worldwide public health concern characterized by chronic hyperglycemia resulting from defects in insulin secretion, insulin action, or both.¹ The global burden of diabetes continues to rise, disproportionately affecting low- and middle-income countries where healthcare systems face challenges in long-term disease management.² Effective control of T2DM depends largely on sustained pharmacological therapy and modification of lifestyle; however, achieving optimal glycemic control remains difficult due to poor medication adherence among patients.³

Medication adherence refers to the extent to which patients take medications as prescribed by healthcare providers and is essential for preventing disease progression, reducing complications, and improving quality of life.⁴ Poor adherence has been consistently associated with suboptimal glycemic control, increased risk of hospitalization, and higher healthcare costs.^{5,6} Despite advances in diabetes management, adherence rates among patients with T2DM remain suboptimal globally, indicating a persistent gap between clinical recommendations and actual patient behavior. Previous studies have reported that only 36-93% of patients adhere adequately to antidiabetic medications, with an average adherence rate of approximately 60-70%, while nearly 45% of patients in developing countries fail to achieve optimal adherence, leading to poor glycemic control and increased risk of complications.^{7,8}

Several factors influence medication adherence in individuals with T2DM, including socio-demographic characteristics, patient knowledge, psychological factors, and healthcare system-related barriers.⁹ Evidence suggests that patients with better knowledge and understanding of diabetes and its treatment demonstrate higher adherence rates.¹⁰ Additionally, factors such as educational level, effective counselling, and strong patient-provider communication have been identified as significant determinants of adherence.^{11,12}

Recent studies also emphasize the role of patient-centered approaches and innovative strategies in improving adherence. Interventions focusing on education, behavioral modification, and healthcare accessibility have shown promising results, although their effectiveness varies across different populations and healthcare settings.^{13,14} Furthermore, medication adherence has been shown to be closely linked with improved clinical outcomes and enhanced quality of life among patients with diabetes.^{14,15}

The global burden of diabetes continues to increase at an alarming rate, with recent estimates indicating that over 530 million adults were living with diabetes worldwide in 2021, a number projected to rise substantially in the coming decades, particularly in low- and middle-income

countries such as Bangladesh.¹⁶ Recent evidence highlights that suboptimal medication adherence remains a major contributor to poor glycemic control and increased risk of both microvascular and macrovascular complications.¹⁷ Furthermore, systematic reviews conducted in recent years have identified that adherence is influenced not only by individual patient characteristics but also by health system factors, including accessibility, affordability, and continuity of care.¹⁸ In Bangladesh, where healthcare resources are often constrained and out-of-pocket expenditure is high, these challenges may be even more pronounced, yet context-specific evidence on adherence patterns and their determinants remains limited.

Although a growing body of literature has examined medication adherence in patients with T2DM globally, there remains a lack of comprehensive, context-specific evidence from Bangladesh that integrates socio-demographic, clinical, and healthcare system factors. In particular, limited attention has been given to the role of social support mechanisms, such as living status, and their influence on adherence behavior. Therefore, this study aimed to assess the patterns and levels of medication adherence and determine the socio-demographic, clinical, and healthcare-related determinants of medication adherence among individuals with type 2 diabetes mellitus in selected regions of Bangladesh, with particular emphasis on the role of living status and social support.

METHODS

This facility-based cross-sectional study was conducted among patients with type 2 diabetes mellitus (T2DM) attending selected hospitals in Gazipur and Manikganj districts of Bangladesh. The data collection was carried out over a period of seven months, from September 2024 to March 2025. Adult patients aged 18 years and above, diagnosed with T2DM for at least six months and receiving antidiabetic treatment, were included in the study. Patients with severe acute illness, cognitive impairment, gestational diabetes, or incomplete medical records were excluded. A simple random sampling technique was applied to select participants from outpatient department registries, and a total of 412 patients were included.

Data were collected through face-to-face interviews using a structured and pretested questionnaire. The interviews were conducted in designated areas near the outpatient departments while maintaining privacy and confidentiality. The questionnaire comprised sections on sociodemographic characteristics (including living status), clinical profile, behavioral factors, and medication adherence. Medication adherence was assessed using the validated 8-item Morisky medication adherence scale (MMAS-8) a widely used self-reported instrument designed to evaluate patients' medication-taking behavior. The scale consists of eight items addressing

common barriers to adherence, including forgetfulness, carelessness, and discontinuation of medication when feeling better or worse. Items 1-7 are dichotomous (yes/no), while item 8 is measured on a 5-point Likert scale. The total score ranges from 0 to 8, with higher scores indicating better adherence. Adherence levels were categorized as high (score =8), medium (score =6-7), and low (score <6). Clinical information, including glycemic status and comorbidities, was obtained from patients' medical records and prescription slips.

Data quality was ensured through pretesting of the questionnaire, training of data collectors, and regular supervision during the data collection period. The collected data were entered and analyzed using SPSS version 26. Descriptive statistics such as frequency, percentage, mean, and standard deviation were used to summarize the data. The Chi-square (χ^2) test was applied to assess associations between independent variables and medication adherence. Variables with a p value of less than 0.20 in bivariate analysis were included in a

multivariable logistic regression model to identify independent predictors of adherence. Statistical significance was considered at $p < 0.05$ with 95% confidence intervals. Ethical approval was obtained from the appropriate institutional authority, and written informed consent was secured from all participants prior to data collection.

RESULTS

Table 1 shows that the mean age of the participants was 52.8 ± 11.6 years, with the majority (34.5%) belonging to the 50-59 years age group. Females constituted a slightly higher proportion (54.1%) compared to males (45.9%). Most participants were married (88.3%) and had primary level education (40.0%), while 28.4% had no formal education. Regarding socioeconomic status, 63.1% reported average or above-average income. A large majority (82.5%) were living with family, indicating strong family support systems among the study population.

Table 1: Sociodemographic characteristics of participants (n=412).

Variables	Category	Frequency	Percentage
Age (years)	<40	62	15.0
	40-49	104	25.2
	50-59	142	34.5
	≥ 60	104	25.2
Sex	Male	189	45.9
	Female	223	54.1
Marital Status	Married	364	88.3
	Unmarried/Widowed	48	11.7
Education	No formal education	117	28.4
	Primary	165	40.0
	Secondary and above	130	31.6
Occupation	Employed	162	39.3
	Unemployed/Homemaker	173	42.0
	Others	77	18.7
Living status	Living with family	340	82.5
	Living alone	72	17.5

Table 2: Clinical characteristics of participants (n=412).

Variables	Category	Frequency	Percentage
Duration of diabetes	<5 years	220	53.4
	≥ 5 years	192	46.6
Comorbidity	Yes	239	58.0
	No	173	42.0
Type of medication	Oral drugs only	257	62.4
	Insulin only	87	21.1
	Combination	68	16.5
Number of medications	<3 drugs	250	60.7
	≥ 3 drugs	162	39.3
Glycemic control	Controlled	184	44.7
	Uncontrolled	228	55.3

Table 2 indicates that more than half of the participants (53.4%) had diabetes for less than five years. A considerable proportion (58.0%) had at least one comorbid condition. Most patients (62.4%) were treated with oral antidiabetic drugs, while 16.5% received combination therapy. Polypharmacy (≥ 3 drugs) was observed in 39.3% of participants. Notably, more than half (55.3%) of the patients had uncontrolled glycemic levels, highlighting suboptimal disease management.

Table 3 shows that 31.6% of participants had high medication adherence, while 38.8% had medium adherence and 29.6% had low adherence. This distribution indicates an overall moderate level of medication adherence among patients with T2DM.

Table 3: Medication adherence levels (MMAS-8) (n=412).

Adherence level	Frequency	Percentage
High adherence	130	31.6
Medium adherence	160	38.8
Low adherence	122	29.6

The Chi-square test revealed that several variables of this study were significantly associated with medication adherence. Older participants (≥ 50 years) exhibited significantly higher adherence compared to younger individuals ($p=0.031$). Education showed a strong association, with individuals having secondary or higher education demonstrating markedly better adherence ($p=0.002$).

Table 4: Association between medication adherence and selected variables.

Variables	Category	High adherence (%)	Medium adherence (%)	Low adherence (%)	χ^2	P value
Age (years)	<50	56 (25.7)	78 (35.8)	86 (38.5)	6.73	0.031
	≥ 50	74 (36.2)	82 (40.1)	36 (23.7)		
Education	None	24 (20.5)	46 (39.3)	47 (40.2)	15.28	0.002
	Secondary+	68 (52.3)	38 (29.2)	24 (18.5)		
Comorbidity	Yes	68 (28.5)	94 (39.3)	77 (32.2)	6.47	0.038
	No	62 (35.8)	66 (38.2)	45 (26.0)		
Polypharmacy	<3 drugs	92 (36.8)	102 (40.8)	56 (22.4)	8.42	0.009
	≥ 3 drugs	38 (23.5)	58 (35.8)	66 (40.7)		
Living Status	Living with family	118 (34.7)	136 (40.0)	86 (25.3)	7.12	0.028
	Living alone	12 (16.7)	24 (33.3)	36 (50.0)		

Table 5: Common reasons for non-adherence.

Reason	Frequency	Percentage
Forgetfulness	199	48.2
Financial constraints	138	33.5
Lack of awareness	115	27.9

Table 6: Factors associated with medication adherence.

Variables	Category	AOR	95% CI	P value
Education	Secondary+ versus none	2.14	1.32-3.46	0.002
Duration of DM	<5 years versus ≥ 5 years	1.78	1.10-2.89	0.018
Healthcare Access	Good versus poor	2.67	1.59-4.49	<0.001
Polypharmacy	≥ 3 versus <3 drugs	0.56	0.34-0.91	0.021
Comorbidity	Yes versus no	0.63	0.40-0.98	0.041

AOR = adjusted odds ratio; CI = confidence interval.

Comorbidity status also influenced adherence. Participants without comorbid conditions had higher adherence (35.8%) than those with one or more comorbidities (28.5%), indicating that the presence of multiple health conditions may complicate adherence ($\chi^2=6.47$, $p=0.038$).

Polypharmacy was negatively associated with adherence. Patients taking fewer than three medications daily had higher adherence (36.8%) compared to those on three or more medications (23.5%) ($\chi^2=8.42$, $p=0.009$), suggesting that the complexity of medication regimens may reduce adherence.

Participants living with family demonstrated higher levels of adherence compared to those living alone ($\chi^2=7.12$, $p=0.028$). A greater proportion of patients living with family exhibited high adherence, whereas those living alone were more likely to have low adherence, suggesting that family support may positively influence medication-taking behavior.

Table 5 shows that forgetfulness was the most commonly reported reason for non-adherence (48.2%), followed by financial constraints (33.5%) and lack of awareness (27.9%). These findings indicate that both behavioral and socioeconomic factors play a significant role in medication adherence.

Table 6 presents the independent predictors of medication adherence. Participants with secondary or higher education were more than twice as likely to adhere to medication compared to those with no formal education. Patients with shorter duration of diabetes (<5 years) also showed better adherence. Good healthcare access significantly improved adherence. In contrast, polypharmacy and the presence of comorbidities were associated with lower adherence. Additionally, patients living with family demonstrated significantly higher adherence compared to those living alone, highlighting the importance of social and family support in diabetes management.

DISCUSSION

This study assessed the determinants and patterns of medication adherence among patients with type 2 diabetes mellitus in selected hospitals of Bangladesh. The findings revealed that only 31.6% of participants had high adherence, while a considerable proportion exhibited medium (38.8%) and low adherence (29.6), indicating an overall moderate level of adherence. This finding is consistent with previous studies conducted in low- and middle-income countries, where adherence remains a major challenge in diabetes management.¹⁷

Age was found to be significantly associated with medication adherence, with older patients demonstrating better adherence. This may be attributed to increased health awareness, disease experience, and perceived severity among older individuals. Similar findings have been reported in studies conducted in India and Ethiopia, where older age groups showed higher adherence rates.^{19,20}

Educational status emerged as one of the strongest predictors of adherence. Patients with secondary or higher education were significantly more likely to adhere to their medication regimen. Education improves health literacy, enabling patients to better understand disease progression, treatment benefits, and the consequences of non-adherence. This finding aligns with previous literature highlighting education as a key determinant of adherence.^{21,22}

The duration of diabetes also showed a significant association with adherence, with patients having a shorter duration (<5 years) demonstrating better adherence. This may be explained by the phenomenon of “treatment fatigue”, where long-term patients gradually lose motivation to adhere strictly to medication regimens. Additionally, prolonged disease duration is often accompanied by complications and complex treatment adjustments, which can further hinder adherence. Similar findings have been reported in multiple cross-sectional and longitudinal studies, emphasizing the need for sustained behavioral support for long-term patients.²³

Comorbidity and polypharmacy were negatively associated with adherence. Patients with multiple health conditions often require complex medication regimens, which can lead to confusion, increased pill burden, and decreased compliance. This finding is consistent with global evidence suggesting that regimen complexity is a major barrier to adherence.^{8,24}

An important contribution of this study is the inclusion of living status, which showed a significant association with adherence. Patients living with family were more likely to adhere to their medications compared to those living alone. Family support can play a crucial role in reminding patients to take medications, providing emotional support, and assisting with healthcare access. This finding is supported by previous research emphasizing the importance of social and familial support systems in chronic disease management.²⁵

Healthcare access was another significant predictor of adherence. Patients with better access to healthcare services were more likely to maintain adherence, possibly due to regular follow-up, counseling, and availability of medications. This aligns with studies conducted in developing countries where healthcare accessibility directly influences treatment outcomes.²⁶

Forgetfulness, financial constraints, and lack of awareness were the most common reasons for non-adherence. These findings highlight the need for patient-centered interventions such as reminder systems, financial assistance programs, and educational initiatives to improve adherence levels.⁸

Finally, a strong association between medication adherence and glycemic control was observed, reinforcing the critical role of adherence in achieving optimal clinical outcomes. Patients with higher adherence were more likely to have controlled blood glucose levels, consistent with existing evidence.²⁷

The cross-sectional design limits causal inference. Medication adherence was self-reported and may be affected by recall and social desirability bias. As the study was conducted in selected healthcare facilities, the findings may have limited generalizability to the wider population of individuals with type 2 diabetes mellitus in

Bangladesh. Residual confounding from unmeasured factors may also be present.

CONCLUSION

This study demonstrates that medication adherence among patients with type 2 diabetes mellitus in Bangladesh remains suboptimal, with only one-third of patients achieving high adherence. The findings highlight that adherence is influenced by a complex interplay of socio-demographic, clinical, and healthcare system-related factors. Higher educational attainment, shorter disease duration, better healthcare access, and family support were associated with improved adherence, whereas polypharmacy and comorbid conditions posed significant barriers.

These results underscore the need for comprehensive and patient-centered strategies to improve adherence. Interventions should prioritize health education to enhance patient awareness, promote simplified and individualized treatment regimens to reduce pill burden, and strengthen healthcare accessibility through affordable and continuous care services. Additionally, integrating family and community support mechanisms into diabetes management programs may further improve adherence outcomes.

From a policy perspective, strengthening primary healthcare systems, expanding access to essential medications, and implementing cost-reduction strategies are crucial for addressing structural barriers to adherence. Future research should consider longitudinal designs to better understand adherence patterns over time and evaluate the effectiveness of targeted interventions.

Improving medication adherence is essential not only for achieving optimal glycemic control but also for reducing the long-term burden of diabetes-related complications and enhancing the overall quality of life of patients.

Funding: No funding sources

Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee

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Cite this article as: Sultana J, Khan MM, Ali MN, Samira NA, Sristy US, Billah M, et al. Determinants and patterns of medication adherence among individuals with type 2 diabetes mellitus. *Int J Community Med Public Health* 2026;13:5568-74.