

Original Research

A Prospective Cohort Study of Medication Adherence and Glycemic Control Outcomes Among Newly Diagnosed Type 2 Diabetes Patients

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ABSTRACT:

Background: Type 2 diabetes mellitus is a chronic metabolic disorder that requires lifelong pharmacological therapy and lifestyle modification to achieve optimal glycemic control and prevent complications. Early management after diagnosis plays a critical role in determining long-term outcomes. However, medication non-adherence remains a major barrier to effective glycemic control, particularly in routine clinical practice. Understanding adherence patterns and their relationship with glycemic outcomes among newly diagnosed patients is essential for improving early diabetes care in tertiary healthcare settings. **Aim:** The aim of this study was to evaluate medication adherence and its association with glycemic control outcomes among newly diagnosed type 2 diabetes mellitus patients attending a tertiary care hospital. **Materials and Methods:** This prospective cohort study was conducted among 102 newly diagnosed type 2 diabetes mellitus patients at a tertiary care hospital. Patients aged 18 years and above who were initiated on antidiabetic therapy were included. Sociodemographic data, clinical characteristics, lifestyle factors, and comorbidities were collected using a structured data collection form. Medication adherence was assessed using a validated self-reported medication adherence questionnaire and categorized into high, medium, and low adherence levels. Glycemic control was evaluated using fasting blood glucose, postprandial blood glucose, and glycated hemoglobin (HbA1c) values obtained from laboratory records. **Results:** Among the 102 participants, 50.98% were aged between 41–60 years and 58.82% were males. High medication adherence was observed in 43.14% of patients, while 35.29% and 21.57% demonstrated medium and low adherence, respectively. Controlled HbA1c levels ($\leq 7\%$) were achieved by only 39.22% of patients. A statistically significant association was found between medication adherence and glycemic control, with 63.64% of patients with high adherence achieving controlled HbA1c compared to 27.78% and 9.09% among medium and low adherence groups, respectively ($p < 0.001$). **Conclusion:** The study highlights a high prevalence of suboptimal medication adherence and poor glycemic control among newly diagnosed type 2 diabetes patients. Improved medication adherence was strongly associated with better glycemic outcomes. Early interventions focusing on adherence enhancement may play a crucial role in achieving optimal glycemic control and improving long-term diabetes management.

Keywords: Type 2 diabetes mellitus; Medication adherence; Glycemic control; HbA1c

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INTRODUCTION

Type 2 diabetes mellitus (T2DM) is one of the most important non-communicable diseases worldwide and a major contributor to premature morbidity and mortality through its microvascular and macrovascular complications. Beyond the direct clinical burden, T2DM imposes sustained costs on families and health systems because it requires lifelong monitoring, pharmacotherapy, and risk-factor control. A substantial proportion of adults with diabetes remain undiagnosed for years, and many present only after chronic hyperglycemia has already initiated vascular injury. As a result, the time around

diagnosis represents a critical opportunity to initiate effective treatment, establish self-management routines, and prevent early deterioration in glycemic control. Global estimates continue to highlight the expanding scale of diabetes and the need for health systems to strengthen early care pathways, particularly in settings where tertiary hospitals receive large numbers of newly identified patients.¹T2DM is characterized by progressive β -cell dysfunction with variable degrees of insulin resistance, resulting in chronic hyperglycemia. Diagnosis is typically established using fasting plasma glucose, 2-hour plasma glucose values during an oral glucose

tolerance test, glycated hemoglobin (HbA1c), or random plasma glucose in the presence of classic symptoms. The use of HbA1c is particularly valuable because it reflects average glycemia over approximately 2–3 months and is widely used both for monitoring and for defining glycemic targets. Most clinical guidelines recommend individualized glycemic goals, but commonly used targets include achieving HbA1c at or below 7% for many non-pregnant adults, balancing benefit with safety and patient-specific factors. Standardized diagnostic and classification approaches help ensure early identification and appropriate initiation of therapy, especially when patients first enter structured care at tertiary centers.² Evidence accumulated over several decades demonstrates that improving glycemic control reduces the risk of diabetic complications. Large prospective trials established that lowering glucose substantially decreases microvascular endpoints, while longer-term follow-up supports the concept that early intensive control can confer persistent benefit even when glycemic differences narrow over time. In overweight individuals with T2DM, metformin-based approaches have shown benefits for diabetes-related outcomes and are widely considered foundational in pharmacologic management where not contraindicated.³ These data underscore that the quality of early glycemic control—often set during the first months after diagnosis—can influence downstream trajectories of complications, healthcare utilization, and quality of life. Therefore, measuring real-world outcomes among newly diagnosed patients is clinically meaningful, because it reflects how effectively early evidence-based care is translated into routine practice. Long-term follow-up of landmark cohorts further emphasizes the importance of early management. Observational follow-up after initial randomized treatment strategies has shown that the benefits of improved glycemic control on complications may persist, supporting the “legacy effect” of earlier glucose lowering.⁴ This is particularly relevant for newly diagnosed patients, for whom early treatment decisions and behaviors may determine whether they quickly achieve stable glycemic targets or continue with sustained hyperglycemia. In many clinical contexts, patients newly diagnosed with T2DM may present with significant baseline dysglycemia, concurrent cardiometabolic risk factors, and limited understanding of chronic disease management. The initial period of care must therefore integrate pharmacotherapy, lifestyle modification, and education in a manner that is feasible for the patient’s social and economic environment. Medication adherence is a central determinant of real-world effectiveness of diabetes therapy. Even when appropriate regimens are prescribed, the intended benefits cannot be achieved if doses are missed, treatment is stopped, or medications are taken inconsistently. Adherence in chronic disease is

influenced by multiple interacting factors such as regimen complexity, adverse effects, medication cost, health literacy, patient beliefs, depression or distress, access barriers, and the quality of patient–provider communication. International public health frameworks emphasize that adherence is not merely an individual choice but a multidimensional behavior shaped by health systems and social context; improving adherence therefore requires identifying barriers and implementing practical, patient-centered strategies.⁵ In T2DM, early adherence may be especially fragile because newly diagnosed individuals are still adjusting to the diagnosis, learning self-care, and developing confidence in long-term treatment. A further challenge in adherence research is measurement. Self-reported instruments are commonly used in routine clinical settings because they are simple, low-cost, and scalable. Validated tools can classify adherence levels and support comparison across patient groups and studies. The 8-item Morisky Medication Adherence Scale (MMAS-8) is one example of a widely used adherence measure with documented predictive validity in outpatient populations.⁶ While self-report tools may be affected by recall and social desirability bias, they remain valuable for identifying patients at risk of poor adherence and for exploring associations with clinical outcomes in real-world cohorts. When combined with objective outcomes such as HbA1c and glucose values, adherence assessments can provide a pragmatic picture of how medication-taking behavior relates to glycemic control. Multiple studies have demonstrated that better adherence to antidiabetic medication is associated with improved glycemic outcomes, whereas poor adherence is linked with higher HbA1c and greater risk of complications. In managed care populations, patients who are adherent to oral antidiabetic medications have been more likely to achieve glycemic control compared with those who are nonadherent, supporting adherence as a modifiable contributor to outcomes beyond drug selection alone.⁷

MATERIALS AND METHODS

This study was designed as a prospective cohort study conducted at a tertiary care hospital. The study aimed to evaluate medication adherence and its association with glycemic control outcomes among patients newly diagnosed with type 2 diabetes mellitus. Eligible participants were enrolled at the time of diagnosis and followed prospectively to assess adherence behaviors and clinical outcomes under routine clinical care. A total of 102 patients newly diagnosed with type 2 diabetes mellitus were included in the study. Newly diagnosed status was confirmed based on clinical evaluation and laboratory criteria as per standard diagnostic guidelines. Patients were recruited from outpatient and inpatient departments of the tertiary care hospital using a consecutive sampling technique to minimize selection bias.

Inclusion and Exclusion Criteria

Patients aged 18 years and above, with a confirmed new diagnosis of type 2 diabetes mellitus, and initiated on oral hypoglycemic agents and/or insulin therapy were included in the study. Patients were required to be capable of understanding and responding to study questionnaires and willing to provide informed consent. Patients with type 1 diabetes mellitus, gestational diabetes, secondary diabetes, severe cognitive impairment, psychiatric illness, critical comorbid conditions, or those already on long-term antidiabetic therapy prior to diagnosis were excluded from the study.

Methodology

Data were collected using a structured and pretested data collection form through patient interviews, medical record reviews, and laboratory reports. Sociodemographic variables included age, gender, educational status, occupation, and socioeconomic status. Clinical parameters included body mass index, blood pressure, family history of diabetes, presence of comorbidities such as hypertension and dyslipidemia, and type of antidiabetic therapy prescribed. Lifestyle-related factors such as smoking status, alcohol consumption, dietary habits, and physical activity levels were also recorded.

Assessment of Medication Adherence

Medication adherence was assessed using a validated self-reported medication adherence questionnaire suitable for patients with chronic diseases. Adherence levels were categorized into high, medium, and low adherence based on predefined scoring criteria. Factors influencing adherence, including forgetfulness, complexity of drug regimen, side effects, cost of medication, and patient understanding of disease and therapy, were also evaluated.

Assessment of Glycemic Control

Glycemic control was assessed using laboratory parameters including fasting blood glucose, postprandial blood glucose, and glycated hemoglobin (HbA1c) levels. These parameters were obtained from hospital laboratory records and used to evaluate the effectiveness of antidiabetic therapy. Glycemic control status was classified according to standard clinical cut-off values.

The primary outcome measure was the association between medication adherence levels and glycemic control outcomes. Secondary outcomes included identification of factors affecting medication adherence and their relationship with clinical and lifestyle parameters.

Statistical Analysis

All collected data were entered into Microsoft Excel and analyzed using the Statistical Package for Social Sciences (SPSS) version 16.0. Descriptive statistics were used to summarize sociodemographic, clinical,

and adherence-related variables. Continuous variables were expressed as mean and standard deviation, while categorical variables were presented as frequencies and percentages. Inferential statistical tests such as chi-square test, independent t-test, and Pearson correlation analysis were applied to assess the association between medication adherence and glycemic control parameters. A p-value of less than 0.05 was considered statistically significant.

RESULTS

Sociodemographic Characteristics of the Study Participants

The sociodemographic characteristics of the 102 study participants are summarized in Table 1. The majority of patients belonged to the age group of 41–60 years, accounting for 50.98%, indicating that type 2 diabetes mellitus was most commonly diagnosed in middle-aged adults. Patients aged 18–40 years constituted 27.45% of the study population, while those above 60 years comprised 21.57%. With respect to gender distribution, males predominated the study population, representing 58.82%, whereas females accounted for 41.18%. Educational status analysis revealed that more than half of the participants (52.94%) had primary or secondary education, followed by graduates and above (29.41%), while 17.65% of patients were illiterate. Socioeconomic status assessment showed that a majority of participants belonged to the middle socioeconomic class (47.06%), followed by the low socioeconomic group (33.33%), with only 19.61% representing the high socioeconomic category.

Clinical and Lifestyle Characteristics of the Study Participants

Table 2 presents the clinical and lifestyle characteristics of the participants. Assessment of body mass index showed that a substantial proportion of patients were overweight (45.10%) or obese (31.37%), indicating a high prevalence of excess body weight among newly diagnosed type 2 diabetes patients. Only 23.53% of participants had a normal body mass index. Hypertension was present in 43.14% of the patients, highlighting a significant burden of comorbid cardiovascular risk factors. Dyslipidemia was observed in 37.25% of participants, while 62.75% did not exhibit lipid abnormalities. Lifestyle behavior analysis showed that 29.41% of participants were smokers, whereas the majority (70.59%) were non-smokers. Physical activity assessment revealed that 60.78% of patients reported irregular physical activity, while only 39.22% engaged in regular exercise, suggesting suboptimal lifestyle practices among the study population.

Distribution of Medication Adherence Levels

The distribution of medication adherence levels among the study participants is depicted in Table 3. High medication adherence was observed in 43.14%

of patients, indicating that less than half of the participants consistently followed their prescribed antidiabetic regimen. Medium adherence was noted in 35.29% of patients, while 21.57% demonstrated low adherence to medication.

Glycemic Control Status of the Study Participants

Glycemic control status based on laboratory parameters is shown in Table 4. Controlled fasting blood glucose levels were observed in 45.10% of participants, whereas 54.90% had uncontrolled fasting glucose values. Postprandial blood glucose levels were controlled in 41.18% of patients, while a higher proportion (58.82%) exhibited uncontrolled postprandial glucose levels. Assessment of long-term glycemic control using HbA1c revealed that only 39.22% of patients achieved controlled HbA1c levels ($\leq 7\%$), whereas the majority (60.78%) had HbA1c values greater than 7%, indicating poor overall glycemic control among newly diagnosed patients.

Association Between Medication Adherence and Glycemic Control

The association between medication adherence and glycemic control, as assessed by HbA1c levels, is presented in Table 5. Among patients with high medication adherence, 63.64% achieved controlled HbA1c levels, while 36.36% had uncontrolled HbA1c. In contrast, only 27.78% of patients with medium adherence and 9.09% of patients with low adherence achieved controlled HbA1c levels. A markedly higher proportion of patients with low adherence (90.91%) exhibited uncontrolled HbA1c levels. Statistical analysis using the chi-square test demonstrated a highly significant association between medication adherence and glycemic control ($p < 0.001$), indicating that higher medication adherence was strongly associated with better glycemic outcomes.

Table 1. Sociodemographic Characteristics of the Study Participants (n = 102)

Variable	Category	Frequency (n)	Percentage (%)
Age group (years)	18–40	28	27.45
	41–60	52	50.98
	>60	22	21.57
Gender	Male	60	58.82
	Female	42	41.18
Educational status	Illiterate	18	17.65
	Primary/Secondary	54	52.94
	Graduate and above	30	29.41
Socioeconomic status	Low	34	33.33
	Middle	48	47.06
	High	20	19.61

Table 2. Clinical and Lifestyle Characteristics of the Study Participants (n = 102)

Variable	Category	Frequency (n)	Percentage (%)
Body Mass Index	Normal	24	23.53
	Overweight	46	45.10
	Obese	32	31.37
Hypertension	Present	44	43.14
	Absent	58	56.86
Dyslipidemia	Present	38	37.25
	Absent	64	62.75
Smoking status	Smoker	30	29.41
	Non-smoker	72	70.59
Physical activity	Regular	40	39.22
	Irregular	62	60.78

Table 3. Distribution of Medication Adherence Levels (n = 102)

Medication adherence level	Frequency (n)	Percentage (%)
High adherence	44	43.14
Medium adherence	36	35.29
Low adherence	22	21.57

Table 4. Glycemic Control Status Among Study Participants (n = 102)

Glycemic parameter	Category	Frequency (n)	Percentage (%)
Fasting Blood Glucose	Controlled	46	45.10
	Uncontrolled	56	54.90

Postprandial Blood Glucose	Controlled	42	41.18
	Uncontrolled	60	58.82
HbA1c	≤7% (Controlled)	40	39.22
	>7% (Uncontrolled)	62	60.78

Table 5. Association Between Medication Adherence and Glycemic Control (HbA1c) (n = 102)

Medication Adherence	Controlled HbA1c n (%)	Uncontrolled HbA1c n (%)	Total	p-value
High adherence	28 (63.64)	16 (36.36)	44	
Medium adherence	10 (27.78)	26 (72.22)	36	
Low adherence	2 (9.09)	20 (90.91)	22	
Total	40 (39.22)	62 (60.78)	102	<0.001*

*Chi-square test applied; p-value < 0.05 considered statistically significant.

DISCUSSION

In the present cohort of 102 newly diagnosed type 2 diabetes patients, middle age predominated, with 50.98% in the 41–60 years group and 21.57% aged >60 years, while males (58.82%) outnumbered females (41.18%). This pattern is consistent with clinic-based observations that type 2 diabetes is commonly detected in the 5th–6th decade with a modest male predominance; for example, a Malaysian clinic study reported a mean age of 58.15 years with 50.70% males (Al-Qazaz et al., 2011)⁸, which broadly aligns with the age–sex structure seen in our tertiary-care cohort.

Educational and socioeconomic profiling in our study showed that 52.94% had primary/secondary education, 17.65% were illiterate, and 47.06% belonged to the middle socioeconomic class. While our hospital cohort contained a large middle/low socioeconomic representation, population-level Indian data suggest a strong socioeconomic gradient in diabetes occurrence: nationally, self-reported diabetes prevalence was 1.5% overall, rising to 1.9% among the highest education group and 2.5% among the highest wealth group, with higher education (OR 1.87) and richest wealth quintile (OR 4.04) showing significantly higher odds (Corsi et al., 2012)⁹. This contrast implies that although diabetes risk may rise with higher SES in the general population, tertiary-care case-mix can still be dominated by middle/low SES because of referral patterns, healthcare access pathways, and local catchment characteristics.

Excess adiposity was highly prevalent in this newly diagnosed cohort: 45.10% were overweight and 31.37% were obese (combined 76.47%), supporting obesity as a major phenotype at diagnosis. Community evidence from India also demonstrates a strong obesity–diabetes overlap; in a rural Indian study of adults, diabetes prevalence increased across higher weight categories with 15.50% among overweight and 20.20% among obese participants (Mandal et al., 2014)¹⁰. Taken together, our high overweight/obesity burden at diagnosis and the graded population risk reported elsewhere reinforce that weight-centric prevention and early lifestyle intervention remain critical even at the point of first diagnosis.

Comorbidity and risk-behavior clustering was notable in our sample, with hypertension in 43.14%, dyslipidemia in 37.25%, and current smoking in 29.41%. In contrast, a large Indian multicenter real-world dyslipidemia study in type 2 diabetes reported a lower smoking prevalence (10.45%) and a mean BMI of 26.81 kg/m², with males comprising 56.42% (Mithal et al., 2014)¹¹. The higher smoking proportion in our cohort may reflect regional differences and the “newly diagnosed” window where risk behaviors remain unmodified, emphasizing the need for early, structured counseling on smoking cessation alongside cardiometabolic risk management.

Glycemic control was suboptimal in this study despite being newly diagnosed: HbA1c ≤7% was achieved by only 39.22%, while 60.78% remained uncontrolled; similarly, fasting glucose was uncontrolled in 54.90% and postprandial glucose in 58.82%. Comparable clinic-based findings have been reported; for instance, in a primary-care diabetes sample, 48.00% had poor glycemic control (HbA1c ≥7.0%) (Wong et al., 2014)¹². The worse HbA1c profile in our cohort (60.78% uncontrolled) may reflect delayed presentation at diagnosis, early therapeutic inertia, or limited lifestyle adaptation immediately after diagnosis in routine tertiary-care practice.

Medication adherence distribution in our cohort showed that only 43.14% had high adherence, while 35.29% and 21.57% had medium and low adherence, respectively—meaning 56.86% were below “high adherence.” A Palestinian study reported 42.70% of type 2 diabetes patients were non-adherent (Sweileh et al., 2014)¹³, which is comparable to the magnitude of suboptimal adherence when considering differences in adherence instruments and category thresholds.

The adherence–glycemia relationship in our results showed a clear dose-response: 63.64% of the high-adherence group achieved controlled HbA1c, compared with 27.78% in medium adherence and only 9.09% in low adherence; conversely, uncontrolled HbA1c was highest in low adherence (90.91%). This strong association was statistically significant (p < 0.001). Prior clinic evidence similarly supports that higher adherence is linked with better glycemic profiles; in Penang, higher adherence scores were significantly associated with lower HbA1c, and both adherence and knowledge predicted better

glycemic control in multivariable analysis (Al-Qazaz et al., 2011)¹⁴. Our findings extend this relationship specifically to the “newly diagnosed” cohort, highlighting that adherence behavior early in the disease course may meaningfully shape early glycemic trajectories.

Finally, our findings underscore that improving adherence could be a high-yield target for early diabetes care pathways in tertiary hospitals: although lifestyle and comorbidities contribute, the largest glycemic differences in our dataset were stratified by adherence category (controlled HbA1c 63.64% vs 9.09% in high vs low adherence). Population-level Indian evidence also indicates that social position, education, and wealth are tightly linked with diabetes distribution and risk behaviors (Corsi et al., 2012)¹⁵ suggesting that adherence interventions may need to be tailored to patients’ educational and socioeconomic context to be maximally effective in real-world settings, particularly soon after diagnosis when routines and beliefs about treatment are being formed.

CONCLUSION

This prospective cohort study demonstrates that a substantial proportion of newly diagnosed type 2 diabetes patients had suboptimal medication adherence and poor glycemic control at the time of tertiary care follow-up. Higher levels of medication adherence were significantly associated with better glycemic outcomes, particularly improved HbA1c control. The findings highlight medication adherence as a key modifiable factor influencing early diabetes management. Strengthening patient education, adherence monitoring, and individualized support soon after diagnosis may improve glycemic control and reduce future diabetes-related complications.

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