



## Impact of Patient Counselling on Medication Adherence in Type 2 Diabetes Mellitus: A Prospective Observational Study

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### Abstract

Diabetes mellitus (DM) is a chronic metabolic disorder characterized by impaired insulin secretion or resistance, leading to significant morbidity and mortality. Global age-standardized fatality rates due to diabetes increased by 3% between 2000 and 2019, with a 13% rise in diabetes-related mortality in lower-middle-income countries. Poor medication adherence is a major contributing factor to diabetes complications, necessitating effective interventions to enhance therapeutic outcomes. A 6-month prospective observational study was conducted in the outpatient department (OPD) of a 500-bed tertiary care teaching hospital to assess medication adherence among patients with Type 2 Diabetes Mellitus (T2DM). The study evaluated adherence using a validated scale before and after structured pharmacist-led counseling. Data on patient demographics, treatment history, and adherence scores were collected and statistically analyzed using paired t-tests. Among the 101 enrolled patients, 55% were male and 45% were female, with the highest prevalence observed in the 50–59-year age group (37.6%). Metformin was identified as the most commonly prescribed antidiabetic medication, accounting for 53.5% of prescriptions. The study found that pre-counseling adherence scores (mean  $\pm$  SD:  $3.71 \pm 1.42$ ) significantly improved after pharmacist-led counseling ( $6.11 \pm 1.18$ ;  $p < 0.001$ ), reflecting a 64.53% enhancement in medication adherence. The findings highlight that clinical pharmacist involvement plays a crucial role in improving medication adherence among T2DM patients,



potentially reducing complications and the overall healthcare burden. Integrating pharmacists into multidisciplinary diabetes care teams is recommended to optimize therapeutic outcomes and improve patient health.

**Keywords:** Adherence, Prospective, Complications, Outcomes, Patient Counselling.

## **Introduction:**

Diabetes mellitus is a chronic metabolic disorder characterized by insufficient insulin production by the pancreas or impaired insulin utilization by the body (World Health Organization [WHO], 2023). Between 2000 and 2019, age-standardized mortality rates attributed to diabetes increased by 3% globally, with a more pronounced rise of 13% observed in lower-middle-income countries (WHO, 2023). Recent epidemiological data indicate that approximately 10.5% of the global adult population (aged 20–79 years) has diabetes, yet nearly half of these individuals remain undiagnosed (International Diabetes Federation [IDF], 2018).

India exemplifies the growing burden of diabetes, ranking second worldwide in the number of affected adults, with an estimated 65.1 million cases reported in 2013 (Ramachandran et al., 2014). Projections suggest that without effective public health interventions, this figure could escalate to 109 million by 2035 (Ramachandran et al., 2014). While improvements in glycemic control have been documented—such as a decline in the national mean A1C from 7.82% (1999–2000) to 7.18% (2004) according to the National Health and Nutrition Examination Survey (NHANES)—significant disparities persist across demographic groups (Hoerger et al., 2008).

Racial and ethnic minorities are disproportionately affected by diabetes. NHANES data from 2017–2020 reveal an increasing prevalence among non-Hispanic Black populations, highlighting persistent health inequities (Harding et al., 2019). Structural deficiencies in healthcare delivery further exacerbate these disparities. Many healthcare systems remain fragmented, inefficient in data management, and poorly adapted for chronic disease care, despite interventions aimed at improving adherence to clinical guidelines (American Diabetes Association [ADA], 2010).

Indigenous populations, comprising over 476 million individuals across 90 countries, face additional challenges due to historical marginalization and systemic health inequities stemming from colonization (Ramachandran et al., 2014). Consequently, diabetes has emerged as a critical health disparity in these communities, with prevalence rates significantly higher than in non-Indigenous populations (Bailey & Kodack, 2011).

## **Types of Diabetes and Their Complications**

Diabetes mellitus is classified into two primary forms: type 1 diabetes (T1D) and type 2 diabetes (T2D), each with distinct etiologies, pathophysiological mechanisms, and management approaches. Type 1 diabetes (T1D), previously termed insulin-dependent or juvenile-onset diabetes, is characterized by autoimmune-mediated destruction of pancreatic  $\beta$ -cells, leading to absolute insulin deficiency (Centers for Disease Control and Prevention [CDC], 2022). Individuals with T1D require lifelong exogenous insulin administration to maintain glycemic



control and prevent acute complications such as diabetic ketoacidosis (DKA). Type 2 diabetes (T2D), the more prevalent form, arises from insulin resistance and progressive  $\beta$ -cell dysfunction, impairing glucose homeostasis (International Diabetes Federation [IDF], 2013). Key risk factors include genetic predisposition, obesity, and physical inactivity. Unlike T1D, T2D is often preventable or modifiable through lifestyle interventions. Early diagnosis and management are critical in mitigating long-term complications (IDF, 2013).

### **Microvascular and Macrovascular Complications**

A systematic review of PubMed and MEDLINE databases using MeSH terms (Diabetes Mellitus, Diabetes Complications, Hyperglycemia, ESRD, Retinopathy, Neuropathy, Amputations, Cardiovascular Disease, Infections, Cancer, Dementia) identified strong associations between diabetes duration, glycemic control, and complication severity (Messersmith et al., 2023). Microvascular complications (e.g., retinopathy, nephropathy, neuropathy) are more prevalent in T1D due to prolonged hyperglycemia. Macrovascular complications (e.g., coronary artery disease, stroke, peripheral vascular disease) account for the majority of T2D-related mortality (Shah et al., 2003).

### **Clinical Manifestations of Diabetes**

Common symptoms include polyuria, polydipsia (excessive thirst), xerostomia (dry mouth), fatigue, unintentional weight loss, delayed wound healing, recurrent infections, blurred vision, and peripheral neuropathy (tingling/numbness) (Sahoo et al., 2022). Due to the insidious onset of T2D, many individuals remain undiagnosed for years, increasing the risk of irreversible complications.

### **Challenges in Treatment Adherence**

Adherence—defined as the degree to which patient behavior aligns with medical advice—is suboptimal in T2D management (Sweileh et al., 2005). Studies indicate that poor adherence contributes to inadequate glycemic control, exacerbating complications (Shaimol et al., 2018). Barriers include complex dosing regimens, clinical inertia, safety concerns (e.g., hypoglycemia), socioeconomic disparities, limited health literacy, polypharmacy, and lack of social support (IDF, 2013).

## **Methodology:**

### **Study Design and Setting**

A prospective observational study was conducted in the outpatient department (OPD) of a 500+ bedded multispecialty teaching hospital to evaluate medication adherence among patients diagnosed with Type 2 Diabetes Mellitus (T2DM). The study aimed to assess the impact of structured clinical pharmacist-led counseling on patient adherence to antidiabetic therapy. Study Population: Patients diagnosed with T2DM attending the OPD were recruited based on predefined inclusion and exclusion criteria. Patients with cognitive impairment, severe comorbidities, or those unwilling to participate were excluded from the study.



## Data Collection and Study Tool

A structured data collection form was used to gather patient information, including:

- Socio-demographic details (age, gender, education, occupation, etc.)
- Medical history (duration of diabetes, comorbid conditions, complications)
- Medication history (prescribed drugs, dosage regimen, duration)
- Current complaints and symptoms

Medication adherence was assessed using a validated medication adherence scale, which was reviewed by medical and pharmacy professionals for reliability and accuracy.

## Intervention and Follow-up

- Pre-counseling adherence assessment: Patients' baseline medication adherence scores were recorded before any intervention.
- Clinical pharmacist-led counseling: Patients received structured counseling sessions, focusing on the importance of adherence, medication use, lifestyle modifications, and glycemic control.
- Post-counseling adherence assessment: Follow-up assessments were conducted during subsequent visits using the same medication adherence scale to evaluate improvements in adherence behavior.

## Statistical Analysis

The collected data were analyzed using paired t-tests to compare pre- and post-counseling medication adherence scores. A p-value of  $<0.05$  was considered statistically significant. This study aimed to provide evidence on the role of clinical pharmacists in improving medication adherence among T2DM patients, thereby contributing to better glycemic control and reduced complications.

## Result and Discussion:

This study aimed to evaluate the impact of pharmacist-led counseling on medication adherence in patients with Type 2 Diabetes Mellitus (T2DM) over an 8-week period. The primary objective was to assess adherence levels before and after counseling, providing insights into the effectiveness of structured patient education in improving treatment compliance.

## Patient Enrollment and Data Collection

During scheduled medical sessions, relevant patient details were collected. A total of 111 patients were initially enrolled in the study. However, 10 patients (10%) were excluded due to incomplete follow-up data. The final study population consisted of 101 patients (90%) who had complete pre- and post-counseling adherence assessments.



### Incidence of Type 2 Diabetes Mellitus by Gender

Among the 101 patients, 56 were male (55%) and 45 were female (45%), indicating a higher prevalence of T2DM in males within the study population. This finding aligns with existing literature suggesting that men may be at a greater risk of developing diabetes due to lifestyle factors, metabolic differences, and lower healthcare engagement compared to women. These results highlight the importance of targeted interventions to improve medication adherence across different demographic groups, ensuring optimal disease management and reducing the risk of diabetes-related complications.

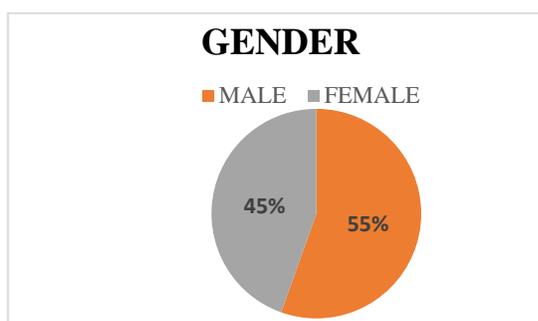


Figure 1 Incidence of Diabetes Mellitus by Gender

### History of Diabetes Mellitus (DM) Duration

The duration of diabetes plays a crucial role in disease progression, complications, and adherence to treatment protocols. Table 1 presents the distribution of patients based on the number of years they have been living with Type 2 Diabetes Mellitus.

Table 1: Distribution of Patients Based on DM History

History of DM (Years)	No of Patients	Percentage (%)
Upto 1 Year	13	12.8
1-2 Years	21	20.7
3-5 Years	38	37.6
More Than 5 Years	29	28.7

### Analysis and Interpretation

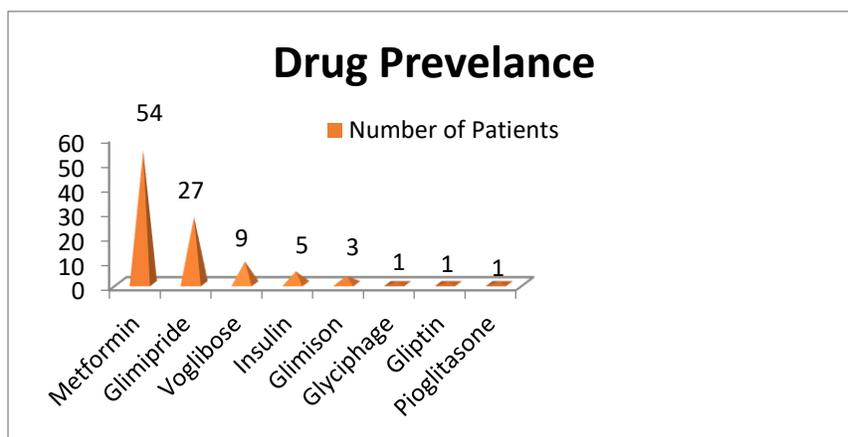


Figure 2 Incidence of Prescribed Drugs among Patients

Among the 101 patients, the highest proportion (37.6%) had been diagnosed with diabetes for 3–5 years, indicating that a significant number of individuals experience challenges in adherence and glycemic control in this phase. The lowest prevalence (12.8%) was observed in patients diagnosed within the past year, suggesting that early intervention strategies should be emphasized to improve long-term adherence and disease management. These findings reinforce the need for early and continuous patient education, particularly targeting those with longer disease duration, as they are more prone to medication fatigue, treatment resistance, and diabetes-related complications.

### Prescription Pattern of Anti-Diabetic Medications

Among the 101 patients, it was observed that Metformin was the most commonly prescribed medication, with 54 patients (53.5%) receiving it as part of their treatment regimen. This highlights Metformin’s dominant role as a first-line therapy in managing Type 2 Diabetes Mellitus due to its proven efficacy, safety profile, and cost-effectiveness. On the other hand, the least prescribed medications included Glyciphage, Gliptins, and Pioglitazone, indicating either selective prescribing based on patient-specific needs or limited preference by physicians due to safety concerns, patient tolerability, or cost considerations.

These findings reinforce the importance of medication adherence, as Metformin, despite its widespread use, is often associated with gastrointestinal side effects that may influence long-term compliance. Additionally, newer agents like Gliptins are prescribed less frequently, possibly due to their higher cost or restricted use in specific patient populations.

Table 2 Difference in Medication Adherence Score, Pre and Post Counselling

Difference in Medication Adherence Score	No. of Patients	Percentage (%)
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0	2	1.9
1	22	21.7
2	38	37.6
3	20	19.8
4	15	14.8
5	4	3.9
Total	101	100

### Impact of Patient Counseling on Medication Adherence

Data illustrates the difference in medication adherence scores before and after counseling among 101 patients. The findings highlight the effectiveness of patient counseling in improving adherence to diabetes management. The highest improvement was observed in patients with a score difference of 2, accounting for 38 patients (37.6%). A moderate improvement (score difference of 1) was noted in 22 patients (21.7%), while a score difference of 3 or more was recorded in 39 patients (38.5%), signifying a substantial positive impact of counseling interventions.

However, 2 patients (1.9%) showed no improvement in adherence, possibly due to factors such as complex treatment regimens, lack of motivation, or socio-economic constraints. These results emphasize the crucial role of structured patient counseling in diabetes care, as better adherence directly correlates with improved glycemic control and reduced complications. Targeted strategies should be developed to address barriers to adherence in patients who showed minimal or no improvement.

The study aimed to assess the impact of patient counseling on medication adherence among 101 patients with Type 2 Diabetes Mellitus (T2DM). The results demonstrated a significant improvement in adherence levels following counseling. Before counseling, the total medication adherence score for all patients was 375, with a mean score of 3.712. After counseling, the total adherence score increased to 617, with a mean score of 6.108. This indicates a total positive change of 242 points, with an average improvement of 2.396 per patient. These findings highlight the effectiveness of patient counseling in enhancing adherence to prescribed treatment regimens.

Non-adherence to diabetes medications often leads to severe complications, including prolonged hospitalization, worsening of disease conditions, failure of treatment regimens, and increased mortality risk. To mitigate these issues, the study incorporated nutritional counseling, lifestyle modifications, and awareness sessions about the benefits of medication adherence. The goal was



to educate and motivate patients to follow their prescribed regimens consistently, thereby improving health outcomes and reducing diabetes-related complications.

To validate these findings, a statistical analysis using the Paired T-test was conducted. The null hypothesis ( $H_0$ ) assumed no significant change in medication adherence pre- and post-counseling, while the alternative hypothesis ( $H_1$ ) suggested a notable improvement. The calculated t-value was found to be 21.78, which is significantly higher than the table value of 1.984 at a 95% confidence interval ( $df = 100$ ). Since  $t > 1.984$ , the null hypothesis was rejected, confirming a statistically significant enhancement in medication adherence after counseling.

The study findings indicate a remarkable 64.53% improvement in medication adherence, emphasizing the critical role of patient counseling in diabetes management. By providing structured education on medication benefits, lifestyle adjustments, and the importance of adherence, healthcare professionals can significantly enhance treatment outcomes. These results highlight the necessity of integrating counseling programs into routine diabetes care to ensure better disease control and improved patient well-being.

### **Conclusion:**

The findings of this study underscore the critical role of clinical pharmacists in improving medication adherence among patients with Type 2 Diabetes Mellitus. The results demonstrated a significant 64.53% improvement in adherence following structured patient counseling, highlighting the effectiveness of pharmacist-led interventions. The mean medication adherence score increased from 3.71 (pre-counseling) to 6.11 (post-counseling), confirming the positive impact of counseling sessions on patient compliance. Statistical analysis using a paired t-test further validated these findings, with a t-value of 21.78 surpassing the critical value, leading to the rejection of the null hypothesis. Improved medication adherence directly contributes to better glycemic control, reducing the risk of diabetes-related complications such as cardiovascular diseases, nephropathy, and neuropathy. Additionally, enhanced adherence minimizes the economic burden associated with prolonged hospitalizations and treatment failures. The study reinforces the need for integrating clinical pharmacists into multidisciplinary diabetes care teams to ensure continuous patient education, personalized counseling, and effective disease management. Future research with larger sample sizes and extended follow-up periods could further substantiate these findings and refine intervention strategies for better therapeutic outcomes in diabetes management.

### **Future Scope of Study**

The results point to a number of exciting avenues for further study in pharmacist-led medication adherence interventions for people with Type 2 Diabetes Mellitus (T2DM). In order to evaluate the long-term sustainability of better adherence and its relationship to glycaemic control



(HbA1c) and complication rates, the follow-up period could be extended beyond six months. Second, combining digital health resources with conventional counseling, like telepharmacy, SMS reminders, or smartphone apps, may improve adherence even more and ought to be investigated. Third, certain adherence barriers may be better addressed by customized counseling models designed for high-risk populations (e.g., elderly patients, people with low health literacy, or people with long-term diabetes).

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