

Evaluation of Antidiabetic Drug Utilization Patterns in Type 2 Diabetes Mellitus Patients

Mehre Darakhshan Mehdi

Associate Professor, Department of Pharmacology, ESIC Medical College and Hospital, Bihta, Patna, Bihar, India

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Corresponding Author: Dr. Mehre Darakhshan Mehdi

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Abstract:

Background: Type 2 Diabetes Mellitus (T2DM) is a major public health concern requiring long-term pharmacological management. Drug utilization studies help evaluate prescribing trends and rational use of antidiabetic medications.

Aim: To evaluate antidiabetic drug utilization patterns among patients with Type 2 Diabetes Mellitus attending a tertiary care teaching hospital.

Methodology: A prospective observational study was conducted in the Department of Pharmacology, ESIC Medical College and Hospital, Bihta, Patna, Bihar, over one year from January 2023 to December 2023. Eighty adult T2DM patients receiving antidiabetic therapy were enrolled. Demographic, clinical, and prescription-related data were collected and analyzed using descriptive statistics.

Results: Most patients belonged to the 46–60 years age group (37.5%) and were male (57.5%). The majority had diabetes for 1–5 years (40%). Dual therapy was the most commonly prescribed regimen (45%), followed by monotherapy (30%). Metformin was the most frequently prescribed antidiabetic drug (85%), followed by sulfonylureas (47.5%). DPP-4 inhibitors and SGLT-2 inhibitors were prescribed in 30% and 25% of patients, respectively. Generic prescribing was observed in 65% of prescriptions, while 80% of drugs were prescribed from the National List of Essential Medicines.

Conclusion: Metformin-based combination therapy predominated in T2DM management. Prescribing practices demonstrated substantial adherence to rational and evidence-based treatment principles.

Keywords: Type 2 Diabetes Mellitus, Drug Utilization Pattern, Antidiabetic Drugs, Metformin, Prescribing Indicators, Rational Drug Use.

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Introduction

Diabetes mellitus (DM) is one of the most prevalent metabolic long-term disorders and is a significant public health problem globally [1]. It is a condition of persistent hyperglycemia due to defects in insulin secretion, insulin action or both. Long term complications of the disease include multiple organ systems including cardiovascular, renal, nervous and visual systems and contribute to high morbidity and mortality.

The rising incidence of diabetes is now putting a significant burden on the healthcare systems, especially in developing countries where there is a high rate of diabetes due to high rates of obesity, unhealthy diet, sedentary lifestyle and rapid urbanization. Type 2 Diabetes Mellitus (T2DM) is one of the most prevalent diabetes mellitus types, responsible for around 90–95% of diabetes cases and is a major problem for healthcare providers because of its chronicity and complicated management needs [2]. T2DM prevalence has risen

dramatically in the past few decades and likely will continue to rise in the future [3]. Hundreds of millions of people in the world have been diagnosed with diabetes and this number is expected to rise significantly by 2045. India is a diabetic nation and termed as “diabetes capital of the world”, supports a large percentage of the global diabetic population. The high prevalence of diabetes in India is due to genetic susceptibility, fast social-economic changes, urbanization, decreased physical activity and food changes [4]. The rising burden of T2DM has led to a rise in healthcare costs and increased risk of diabetes-related complications, highlighting the importance of effective management strategies to address the disease.

Management of T2DM is mainly to attain and sustain good glycemic control and prevent the onset of complications [5]. Treatment consists of a combination of lifestyle changes and medications.

In the past few years, a few classes of antidiabetic drugs have been developed, such as biguanides, sulfonylureas, thiazolidinediones, sodium-glucose cotransporter-2 (SGLT2) inhibitors, insulin preparations and glucagon-like peptide-1 (GLP-1) receptor agonists [6]. For most patients, the first-line treatment is to use metformin as this is an effective drug, it's safe, and it's inexpensive. Eventually, however, a combination therapy is needed for many patients, as the function of the β -cells declines over time and because other conditions are present.

Prescribing trends and patterns, medication utilisation and treatment guideline adherence have all been evaluated using drug utilisation studies [7]. Such studies are helpful in terms of information about the rational use, effectiveness, safety and cost-effectiveness of prescribed treatments. Analysis of patterns in the use of antidiabetic drugs facilitates the detection of drug prescribing differences, to measure the level of polypharmacy, and to evaluate if the drug use is consistent with the known clinical guidelines [8]. In T2DM, the patient features and disease severity, comorbid conditions, physician preference, drug availability and economics all help shape treatment decisions, making such assessments very relevant.”

“In addition, patients with T2DM often have other comorbidities like hypertension, dyslipidaemia, obesity, cardiovascular disease and chronic kidney disease, which means they need to take more than one drug at the same time. This means patients are more likely to have drug interactions, side effects, not take the medications as prescribed, and develop problems with the medications.

Thus, a sustained surveillance of the prescribing behaviour is crucial for rational use of drugs and for maximising the therapeutic benefit. DUR can also uncover existing gaps in the way drugs are being prescribed and evidence for developing strategies to enhance patient care and utilization of healthcare resources.

The analysis of antidiabetic drug utilization pattern is a crucial element in understanding the status of drug utilization in Type 2 Diabetes Mellitus and assessing its adherence to evidence-based guidelines. Such information can help improve prescribing practices; make treatment more effective; reduce drug-related issues; and, ultimately, improve the quality of care for the diabetic patient.

Methodology

Study Design: The present study was conducted using a prospective observational study design to evaluate antidiabetic drug utilization patterns among patients diagnosed with Type 2 Diabetes Mellitus (T2DM). The study aimed to assess prescribing trends, patterns of antidiabetic drug use,

utilization of monotherapy and combination therapy, and adherence to rational prescribing practices among T2DM patients attending the hospital.

Study Area: The study was conducted in the Department of Pharmacology, ESIC Medical College and Hospital, Bihta, Patna, Bihar, India. Data were collected from patients attending the Outpatient Department (OPD) and those admitted to the Inpatient Department (IPD) who were receiving treatment for Type 2 Diabetes Mellitus.

Study Duration: The study was conducted over a period of one year from January 2023 to December 2023

Study Participants: A total of 80 patients diagnosed with Type 2 Diabetes Mellitus and receiving antidiabetic therapy during the study period were included in the study.”

Inclusion Criteria

- Patients diagnosed with Type 2 Diabetes Mellitus.
- Patients aged 18 years and above.
- Patients receiving one or more antidiabetic medications.
- Patients attending the OPD or admitted to the IPD during the study period.
- Patients willing to participate and provide written informed consent.

Exclusion Criteria

- Patients diagnosed with Type 1 Diabetes Mellitus.
- Pregnant women with gestational diabetes mellitus.
- Patients with severe psychiatric disorders or cognitive impairment.
- Critically ill or unconscious patients unable to provide information.
- Patients unwilling to participate in the study.
- Patients with incomplete medical records or prescription details.

Sample Size: The sample size for the study consisted of 80 patients who fulfilled the eligibility criteria and were enrolled consecutively during the study period.

Procedure: The study was carried out among patients diagnosed with Type 2 Diabetes Mellitus who attended the OPD or were admitted to the IPD of ESIC Medical College and Hospital, Bihta, Patna. Eligible patients were identified based on the inclusion and exclusion criteria. After obtaining informed consent, demographic and clinical information such as age, gender, duration of diabetes, associated comorbidities, and treatment details were recorded using a structured data collection form.

Information regarding prescribed antidiabetic medications was collected from patients' prescriptions, medical records, and medication

charts. The collected data included the class of antidiabetic drugs prescribed, dosage forms, routes of administration, frequency of dosing, duration of therapy, and utilization of monotherapy or combination therapy.

Prescriptions were further evaluated to determine the average number of drugs prescribed per patient, the proportion of drugs prescribed by generic and brand names, and the utilization of medicines listed in the National List of Essential Medicines (NLEM).

The prescribing patterns of various antidiabetic drug classes such as biguanides, sulfonylureas, dipeptidyl peptidase-4 inhibitors, sodium-glucose cotransporter-2 inhibitors, thiazolidinediones, insulin preparations, and fixed-dose combinations were analyzed. The collected data were assessed using standard drug utilization indicators and rational prescribing parameters to evaluate the appropriateness of antidiabetic therapy among study participants.

Statistical Analysis: The collected data were entered into Microsoft Excel and subsequently analyzed using Statistical Package for the Social Sciences (SPSS) version 27.0. Descriptive statistical

methods were employed for data analysis. Categorical variables were expressed as frequencies and percentages, while continuous variables were presented as mean and standard deviation (Mean \pm SD). The results were summarized using tables and charts to provide a clear representation of antidiabetic drug utilization patterns among Type 2 Diabetes Mellitus patients.”

Result

Table 1 presents the demographic characteristics of the 80 study participants. The majority of participants belonged to the 46–60 years age group, accounting for 30 (37.5%) individuals, followed by the 31–45 years age group with 22 (27.5%) participants. Participants aged more than 60 years constituted 18 (22.5%) of the study population, while the 18–30 years age group represented the smallest proportion with 10 (12.5%) individuals. Regarding gender distribution, males were predominant, comprising 46 (57.5%) participants, whereas females accounted for 34 (42.5%). These findings indicate that middle-aged and older adults formed the major proportion of the study population, with a higher representation of male participants than females.

Table 1: Demographic Characteristics of Study Participants (n = 80)

Variable	Number (n)	Percentage (%)
Age Group (Years)		
18–30	10	12.5
31–45	22	27.5
46–60	30	37.5
>60	18	22.5
Gender		
Male	46	57.5
Female	34	42.5

Table 2 presents the distribution of patients according to the duration of Type 2 Diabetes Mellitus among the 80 study participants. The majority of patients, 32 (40%), had a disease duration of 1–5 years, indicating that most cases were in the relatively early phase of diabetes management. This was followed by 22 (27.5%) patients who had diabetes for 6–10 years. A smaller

proportion, 14 (17.5%) patients, had been diagnosed for less than 1 year, while 12 (15%) patients had a disease duration exceeding 10 years.

Overall, the findings suggest that a considerable proportion of the study population had been living with diabetes for several years, highlighting the chronic nature of the condition.

Table 2: Distribution of Patients According to Duration of Type 2 Diabetes Mellitus (n = 80)

Duration of Diabetes	Number (n)	Percentage (%)
<1 Year	14	17.5
1–5 Years	32	40
6–10 Years	22	27.5
>10 Years	12	15
Total	80	100

Table 3 depicts the pattern of antidiabetic drug therapy prescribed among the 80 patients included in the study. Dual therapy was the most commonly prescribed treatment regimen, accounting for 36 (45%) patients, indicating a preference for

combination therapy to achieve better glycemic control. Monotherapy was prescribed to 24 (30%) patients, suggesting its use in individuals with less severe disease or newly diagnosed diabetes. Triple therapy was utilized in 16 (20%) patients, reflecting

the need for intensified treatment in some cases. A small proportion of patients, 4 (5%), received insulin in combination with oral antidiabetic drugs,

indicating more advanced or poorly controlled diabetes. Overall, combination therapy was prescribed more frequently than monotherapy.

Table 3: Pattern of Antidiabetic Drug Therapy Prescribed (n = 80)

Type of Therapy	Number (n)	Percentage (%)
Monotherapy	24	30
Dual Therapy	36	45
Triple Therapy	16	20
Insulin with Oral Antidiabetic Drugs	4	5
Total	80	100

Table 4 depicts the utilization pattern of antidiabetic drug classes among the 80 study participants. Biguanides (Metformin) were the most frequently prescribed antidiabetic agents, used in 68 patients (85%), indicating their predominant role as first-line therapy in the management of type 2 diabetes mellitus.

Sulfonylureas were the second most commonly prescribed class, accounting for 38 prescriptions

(47.5%). DPP-4 inhibitors and SGLT-2 inhibitors were prescribed to 24 (30%) and 20 (25%) patients, respectively, reflecting their growing use as add-on therapies. Insulin preparations were utilized in 12 patients (15%), while thiazolidinediones were the least prescribed class, being used in only 8 patients (10%).

Overall, Metformin remained the cornerstone of antidiabetic therapy in the study population.

Table 4: Utilization Pattern of Antidiabetic Drug Classes (n = 80)

Drug Class	Number of Prescriptions	Percentage (%)
Biguanides (Metformin)	68	85
Sulfonylureas	38	47.5
DPP-4 Inhibitors	24	30
SGLT-2 Inhibitors	20	25
Insulin Preparations	12	15
Thiazolidinediones	8	10

Table 5 presents the prescribing indicators of antidiabetic drug utilization among 80 prescriptions. The findings show that the majority of prescriptions were written by generic name, accounting for 52 (65%) prescriptions, while 28 (35%) were prescribed by brand name. Drugs included in the National List of Essential Medicines (NLEM) were prescribed in 64 (80%) cases, indicating substantial adherence to essential

medicine recommendations. Fixed-dose combinations (FDCs) were utilized in 34 (42.5%) prescriptions, reflecting their common use in diabetes management to improve therapeutic outcomes and patient compliance. Injectable insulin therapy was prescribed to 12 (15%) patients, suggesting that most patients were managed with oral antidiabetic medications.

Table 5: Prescribing Indicators of Antidiabetic Drug Utilization (n = 80)

Prescribing Indicator	Number (n)	Percentage (%)
Prescriptions Written by Generic Name	52	65
Prescriptions Written by Brand Name	28	35
Drugs from NLEM Prescribed	64	80
Fixed-Dose Combinations Used	34	42.5
Patients Receiving Injectable Insulin	12	15

Discussion

The current study aimed to assess the prescribing patterns of antidiabetic drugs in patients with Type 2 Diabetes Mellitus (T2DM) and revealed the antidiabetic drug utilization patterns that were similar to the current diabetes management guidelines. The majority of the patients were found to be in the age group of 46 to 60 years (37.5%) followed by 31 to 45 years (27.5%) in demographic profile. The results obtained are consistent with that of Tanwar et al. (2021) [9] who found that most of the T2DM

patients were between 51 to 60 years of age, suggesting that diabetes is more common among middle aged and older age groups as they are more likely to be exposed to risk factors such as obesity, physical inactivity, unhealthy dietary habit, and metabolic disturbance for a longer period. In a similar study by Acharya (2020), it was seen that the prevalence of diabetes increased with age, with a higher proportion of diabetic patients in the fifth and sixth decade of life. In this study, the majority of the patients were male, 57.5% compared with

42.5% females. This higher ratio of males to females is similar to the findings of Tanwar et al. (2021) which showed around 59% male patients. This is at odds with the findings of Kanaya et al. (2002) [10] who proposed a very similar sex distribution for diabetes prevalence, but higher disease-related complications amongst women.”

“In terms of disease duration, most of the patients in the present study had a duration of 1–5 years (40%), and 6–10 years (27.5%). Acharya 2020 [11] reported a similar picture with most patients having disease duration of less than 10 years. Most of the patients had relatively short disease duration, which could be due to an increased awareness, earlier diagnosis, and more screening. However, a significant 15% of patients with >10 years of disease duration reflects the chronic progressive nature of T2DM and the need for long-term follow-up to avoid complications.

Treatment patterns analysis revealed that dual therapy was the most common treatment (45%), followed by mono therapy (30%) and triple therapy (20%). The results are similar to the study conducted by Tanwar et al. (2021), where almost 66% of patients were treated with combination therapy consisting of two or more antidiabetic drugs. The use of combination therapy is becoming a more common practice as it is more effective than monotherapy in achieving glycemic control and because it addresses multiple pathophysiological defects of T2DM. Current treatment recommendations advocate the use of combination therapy when glycemic targets are not achieved with a single agent (Davies et al., 2018) [12]. The lower percentage of patients treated with insulin and oral antidiabetic drugs (5%) in the current study indicates that the majority of patients were able to maintain good glycemic control with oral medications.

Evaluation of antidiabetic drug classes showed that Metformin use is highest at 85%, which has been the most commonly prescribed drug by all patients. This is a very similar result to that of previous studies. Acharya (2020) noted that more than 80% of the individuals with diabetes are utilizing Metformin, whereas Tanwar et al. (2021) reported that 97% of the prescription is being used for Metformin. The wide adoption of Metformin is likely due to its proven effectiveness, low hypoglycemic risk, favorable safety profile, low cost and weight loss effects on insulin sensitivity (Zhou et al., 2018) [13]. The reasons for the somewhat lower level of utilization in the present study than in Tanwar et al. could be attributed to variations in patient characteristics and prescription preferences. In the current study, the second most frequently used group of drugs was sulfonylureas, prescribed in 47.5% of cases. This percentage was lower than that reported by Tanwar et al. (2021)

which was 65.5%, but it was similar to the ongoing use of sulfonylureas as a second-line therapy to ensure glycemic control in patients not adequately controlled by Metformin. Tomlinson et al. (2022) [14] highlighted the continued use of sulfonylureas due to their potent glucose-lowering effects, ease of availability, and cost-effectiveness, especially in resource-limited countries.” It was also interesting how newer antidiabetic drugs were used. 30% of patients were prescribed DPP-4 inhibitors and 25% were prescribed SGLT-2 inhibitors. This is significantly more than the 8.6% use of DPP-4 inhibitors and 1.0% use of SGLT-2 inhibitors reported by Tanwar et al. (2021). This rise in the use of these newer drug classes in the current study could be attributed to greater awareness of their cardiovascular and renal safety and efficacy, increasing availability, and inclusion in revised treatment guidelines. The remarkable glycemic control achieved by DPP-4 inhibitors and SGLT-2 inhibitors with additional organ-protective effects have been identified by the studies of Cheng et al 2014 [15] and Vallon and Thomson 2017 [16].

Only 15% of participants in the current study were taking insulin therapy, a lower rate than reported by Wallia and Molitch (2014) [17] for hospitalized diabetic patients (58.6%). This difference could be due to the outpatient-based nature of the present study, in which the majority of patients received oral antidiabetic medication. Insulin is used when oral therapy is not enough and usually for severe hyperglycemia, advanced disease. Prescribing indicators were assessed, showing good progress in rational use. It was noticed that 65% of the prescriptions were generic, which is more than the percentage noted by Tanwar et al. (2021) of 55%. This shows that progress is being made towards achieving good cost-effective prescribing, but is still short of the WHO target of 100% generic prescribing. Likewise, there was a high level of adherence to the standard treatment guidelines as 80% of the prescribed drugs were part of the National List of Essential Medicines (NLEM). This is marginally below the 90% observed compliance by Biswas et al. 2000 [18] but is still considered to be rational prescribing practice. The use of fixed-dose combinations was significant at 42.5% of prescriptions, demonstrating their importance in lowering pill burdens and facilitating adherence to treatment among diabetic patients. Based on the results of the present study, Metformin-based therapy is the mainstay of the management of T2DM with the continued rise in the use of DPP-4 inhibitors and SGLT-2 inhibitors. Prescription practices for the management of Type 2 Diabetes Mellitus are rational and based on evidence as reflected in the predominance of dual-drug therapy, significant prescribing of generic medicines and good adherence to essential medicine recommendations.”

Conclusion

The present study provides valuable insights into the antidiabetic drug utilization patterns among patients with Type 2 Diabetes Mellitus at a tertiary care teaching hospital. The findings revealed that T2DM was more prevalent among middle-aged and older adults, with a predominance of male patients. Most participants had a disease duration of 1–5 years, indicating early to moderate stages of disease progression. Dual therapy emerged as the most commonly prescribed treatment regimen, highlighting the importance of combination therapy in achieving optimal glycemic control. Metformin remained the cornerstone of diabetes management, while the increasing use of DPP-4 inhibitors and SGLT-2 inhibitors reflected evolving prescribing practices. The substantial use of generic medicines and NLEM-listed drugs indicated adherence to rational prescribing principles. Overall, the study demonstrated evidence-based and cost-effective antidiabetic prescribing practices, supporting improved therapeutic outcomes and quality patient care.

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