

Drug Utilization Pattern and Prescription Profile in Diabetic Patients at A Tertiary Care Hospital: A Prospective Cross-Sectional Study

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Abstract

Background: The objective is to assess the drug utilization pattern and prescribing indicators among diabetic patients attending the diabetic clinic and medicine outpatient department of a tertiary care hospital. **Material and Methods:** This prospective cross-sectional drug utilization study was conducted in the diabetic clinic and medicine outpatient department of a tertiary care hospital over six months. A total of 610 diabetic patients fulfilling the eligibility criteria were included. Demographic details, type and duration of diabetes, body mass index, comorbidities, antidiabetic drugs, concomitant medications, number of drugs per encounter, generic and brand-name prescribing, injection use, essential medicine list adherence, prescription cost, and PDD:DDD ratio were analyzed using descriptive statistics. **Results:** Among 610 patients, the majority were aged 46–60 years, and the mean age was 51.74 ± 12.51 years. Females constituted 317 (51.97%) patients, and type 2 diabetes mellitus was present in 582 (95.41%) cases. Overweight was the most common BMI category, observed in 334 (54.76%) patients, while hypertension was the commonest comorbidity, seen in 257 (42.13%). A total of 1139 antidiabetic drugs and 2058 total drugs were prescribed. The average number of antidiabetic drugs per encounter was 1.86 ± 0.70 , and the average number of total drugs per encounter was 3.37 ± 2.00 . Metformin was the most commonly prescribed antidiabetic drug, used in 557 (91.31%) patients, followed by sulphonylureas in 332 (54.43%) and insulin in 149 (24.43%). Two-drug combination therapy was the most common treatment pattern, observed in 280 (45.90%) patients, with metformin plus glibenclamide being the most frequent combination. Generic prescribing accounted for 557 (48.90%) antidiabetic drugs, while 582 (51.10%) were prescribed by brand name. The average antidiabetic drug cost per encounter was ₹201.93. The PDD:DDD ratio was highest for glimepiride at 1.920. **Conclusion:** The study demonstrated a metformin-dominant prescribing pattern with frequent use of combination therapy and moderate polypharmacy among diabetic outpatients. Although essential medicine list adherence was satisfactory, generic prescribing remained suboptimal. Regular prescription audits, promotion of generic medicines, and cost-conscious prescribing may improve rational drug use in diabetic outpatient care.

Keywords: Diabetes mellitus; drug utilization study; antidiabetic drugs; metformin; prescribing pattern; generic prescribing; defined daily dose.

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INTRODUCTION

Diabetes mellitus is a chronic metabolic disorder characterized by persistent hyperglycaemia due to impaired insulin secretion, reduced insulin action, or both. It is associated with disturbances in carbohydrate, lipid, and protein metabolism and contributes substantially to morbidity and mortality through microvascular and macrovascular complications.^[1,2] The burden of diabetes has been increasing rapidly in India, mainly due to urbanization, sedentary lifestyle, dietary changes, obesity, and ageing of the population.^[3,4]

The management of diabetes requires long-term lifestyle modification and pharmacological treatment. Oral antidiabetic drugs, insulin, or their combinations are prescribed according to the type of diabetes, duration of disease, glycaemic status, associated comorbidities, and individual patient needs.^[5] Since many diabetic patients also suffer from hypertension, ischemic heart disease, dyslipidaemia, neuropathy, or nephropathy, multiple

medications are often required, increasing the possibility of polypharmacy.^[6]

Rational prescribing is essential in diabetic care because inappropriate drug selection, irrational combinations, excessive use of brand-name drugs, poor generic prescribing, and high treatment cost may affect adherence and long-term glycaemic control.^[7] As diabetes is a lifelong disorder, regular evaluation of prescriptions can help identify prescribing trends, cost burden, and areas where treatment practices can be improved.^[8]

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Drug utilization studies assess the pattern of prescription and use of medicines in a defined population and provide useful information regarding rationality, cost-effectiveness, and quality of care.^[9] Therefore, the present study was undertaken to evaluate the drug utilization pattern among diabetic patients attending the diabetic clinic and medicine outpatient department of a tertiary care hospital, with special focus on antidiabetic drug use, concomitant medications, generic prescribing, essential medicine list adherence, prescription cost, and dose utilization indicators.

MATERIALS AND METHODS

Study Design and Setting: This was a prospective cross-sectional drug utilization study and was conducted by the Department of Pharmacology in association with the Department of Medicine at a tertiary care hospital. The study was carried out among diabetic patients attending the diabetic clinic and medicine outpatient department. The total duration of the study was six months, from October 2013 to March 2014, after obtaining approval from the Institutional Ethics Committee.

Study Population: The study included patients of either sex, aged more than 12 years, with a confirmed diagnosis of diabetes mellitus who attended the diabetic clinic or medicine outpatient department during the study period, including those referred from other departments and already receiving antidiabetic therapy. A total of 610 eligible diabetic patients were enrolled. Indoor patients, individuals with uncertain diagnosis, children below 12 years, pregnant or lactating women, and patients who were subsequently admitted after outpatient evaluation were excluded.

Sample Size: The sample size was based on the World Health Organization recommendation for cross-sectional surveys evaluating current treatment practices, which suggests inclusion of at least 600 encounters. Accordingly, 610 patient encounters were included and analyzed in the present study.

Study Procedure and Data Collection: An appropriate study protocol and case record proforma were prepared before initiation of the study. The protocol and proforma were discussed with faculty members of the Department of Pharmacology and the Head of the Department of Medicine. Eligible patients were informed about the nature and purpose of the study, and written informed consent was obtained before enrolment. After completion of physician consultation, prescriptions were copied, and patients were interviewed. Relevant demographic, clinical, anthropometric, and prescription-related details were recorded in a predesigned and pretested case record form.

Data Recorded: The collected data included patient name, age, sex, weight, height, duration of diabetes, type of diabetes, concurrent medical illnesses, ongoing treatment, and complete prescription details. Drug-related information included the number of antidiabetic drugs per encounter, total number of drugs prescribed per encounter, drug class, individual drug name, use of monotherapy or combination therapy, route of administration, generic or brand-name prescribing, injection use, drugs prescribed from essential

medicine lists, average drug cost, Anatomical Therapeutic Chemical classification, Prescribed Daily Dose, Defined Daily Dose, and PDD:DDD ratio.

Body Mass Index Assessment: Body Mass Index was calculated by dividing body weight in kilograms by the square of height in meters. Patients were categorized as underweight, normal weight, overweight, obesity class I, obesity class II, or extreme obesity according to the BMI classification used in the study protocol.

Drug Utilization Indicators: Drug utilization was assessed using general prescribing and drug-use indicators. These included age and sex distribution, duration of diabetes, concurrent medical illness, BMI pattern, number of antidiabetic drugs per encounter, total number of drugs per encounter, average number of drugs per encounter, commonly used drug groups, utilization pattern of antidiabetic drugs, percentage of antidiabetic drugs prescribed by generic name, percentage of encounters with injection prescribed, percentage of drugs prescribed from essential medicine lists, average drug cost per encounter, and ATC/DDD-based utilization analysis.

Cost Analysis: The average cost of antidiabetic drugs per encounter was calculated for a 30-day prescription. Drug cost was estimated using the minimum listed price of the respective drug from the Current Index of Medical Specialities, April–July 2014. The average drug cost per encounter was calculated by dividing the total antidiabetic drug cost by the total number of encounters.

ATC/DDD Analysis: Antidiabetic drugs were classified according to the Anatomical Therapeutic Chemical classification system. Prescribed Daily Dose and Defined Daily Dose were assessed for commonly prescribed antidiabetic drugs, and the PDD:DDD ratio was calculated to evaluate dose utilization patterns.

Ethical Considerations: The study was conducted after approval from the Institutional Ethics Committee. Written informed consent was obtained from each eligible participant before enrolment. Confidentiality of patient information was maintained throughout the study, and the data were used only for research and analysis purposes.

Statistical Analysis: The collected data were compiled and analyzed using descriptive statistical methods. Categorical variables were expressed as frequency and percentage, while continuous variables such as age, duration of diabetes, number of drugs per encounter, and drug cost were summarized as mean with standard deviation wherever applicable. Drug utilization patterns were presented using prescription indicators, frequency distributions, percentages, average values, and PDD:DDD ratios.

RESULTS

[Table 1] shows that, the majority of patients belonged to the 46–60 years age group, accounting for 314 (51.47%) cases, and the mean age was 51.74 ± 12.51 years. Females constituted a slightly higher proportion of the study population, with 317 (51.97%) cases. Type 2 diabetes mellitus was the predominant diagnosis, observed in 582 (95.41%) patients. Most patients had a diabetes duration of 6–10 years, comprising 240 (39.34%) cases, and the mean duration of diabetes was 6.78 ± 4.29 years. Regarding BMI, overweight was the most common category, seen in 334

(54.76%) patients, followed by obesity class I in 90 (14.75%) cases. Hypertension was the most frequent comorbidity, present in 257 (42.13%) patients, while ischemic heart

disease, hypothyroidism, COPD, and asthma were less commonly reported.

Table 1: Baseline demographic and clinical profile of diabetic patients (n = 610)

Variables	Number (%)
Age group (years)	
12-30	28 (4.59)
31-45	126 (20.66)
46-60	314 (51.47)
>60	142 (23.28)
Mean age (Mean ± SD)	51.74 ± 12.51 years
Sex	
Male	293 (48.03)
Female	317 (51.97)
Type of diabetes	
Type 1 diabetes mellitus	28 (4.59)
Type 2 diabetes mellitus	582 (95.41)
Duration of diabetes	
Newly diagnosed	8 (1.31)
<2 years	54 (8.86)
2-5 years	206 (33.77)
6-10 years	240 (39.34)
>10 years	102 (16.72)
Mean duration of diabetes (Mean ± SD)	6.78 ± 4.29 years
BMI category	
Underweight	20 (3.28)
Normal weight	118 (19.34)
Overweight	334 (54.76)
Obesity class I	90 (14.75)
Obesity class II	26 (4.26)
Extreme obesity class III	22 (3.61)
Comorbidities	
Hypertension	257 (42.13)
Ischemic heart disease	24 (3.93)
Hypothyroidism	14 (2.30)
COPD	12 (1.97)
Asthma	5 (0.82)

Table 2: Prescription burden and drug utilization indicators

Indicator	Result
Total number of patient encounters	610
Total number of antidiabetic drugs prescribed	1139
Average number of antidiabetic drugs per encounter	1.86 ± 0.70
Range of antidiabetic drugs per encounter	1-4
Total number of drugs prescribed	2058
Average number of total drugs per encounter	3.37 ± 2.00
Range of total drugs per encounter	1-10
Patients receiving ≥3 total drugs	358 (58.69%)
Antidiabetic drugs prescribed by generic name	557 (48.90%)
Antidiabetic drugs prescribed by brand name	582 (51.10%)
Encounters with injection prescribed	149 (24.43%)
Drugs prescribed from WHO Essential Medicine List, 2013	21/44 (47.72%)
Drugs prescribed from National Essential Medicine List of India, 2011	33/44 (75.00%)
Total antidiabetic drug cost	₹123180.60
Average antidiabetic drug cost per encounter	₹201.93

A total of 1139 antidiabetic drugs and 2058 total drugs were prescribed across 610 encounters. The average number of antidiabetic drugs per encounter was 1.86 ± 0.70, while the average number of total drugs per encounter was 3.37 ± 2.00. More than half of the patients, 358 (58.69%), received three or more total drugs, indicating a considerable prescription burden. Antidiabetic drugs were prescribed almost equally by generic and brand names, with 557 (48.90%) prescribed

generically and 582 (51.10%) by brand name. Injections were prescribed in 149 (24.43%) encounters. Among the total drugs used, 21 of 44 (47.72%) were listed in the WHO Essential Medicine List 2013, while 33 of 44 (75.00%) were included in the National Essential Medicine List of India 2011. The total antidiabetic drug cost was ₹123180.60, with an average cost of ₹201.93 per encounter. [Table 2]

Table 3: Commonly prescribed antidiabetic and concomitant drug groups among study participants (n = 610)

Drug group / drug	Number (%)
Antidiabetic drugs	
Metformin	557 (91.31)
Sulphonylureas	332 (54.43)
Glibenclamide	200 (32.79)
Glimepiride	66 (10.82)
Glipizide	66 (10.82)
Insulin	149 (24.43)
Pioglitazone	87 (14.26)
Alpha-glucosidase inhibitors	14 (2.30)
Acarbose	8 (1.31)
Voglibose	6 (0.98)
Concomitant medications	
ACE inhibitors / ARBs	278 (45.57)
Beta blockers	134 (21.97)
Calcium channel blockers	83 (13.61)
Diuretics	20 (3.28)
Aspirin	56 (9.18)
Clopidogrel	10 (1.64)
Amitriptyline	65 (10.66)
B-complex and folic acid	60 (9.84)
Atorvastatin	31 (5.08)
Other drugs	182 (29.84)

As shown in [Table 3], Metformin was the most frequently prescribed antidiabetic drug, used in 557 (91.31%) patients, followed by sulphonylureas in 332 (54.43%) patients and insulin in 149 (24.43%) patients. Among sulphonylureas, glibenclamide was the most commonly used agent, prescribed in 200 (32.79%) patients, while glimepiride and glipizide were each prescribed in 66 (10.82%) cases.

Pioglitazone was used in 87 (14.26%) patients, whereas alpha-glucosidase inhibitors were prescribed less frequently. Among concomitant medications, ACE inhibitors or ARBs were the most commonly used drugs, prescribed in 278 (45.57%) patients, followed by beta blockers in 134 (21.97%) and calcium channel blockers in 83 (13.61%) cases.

Table 4: Pattern of antidiabetic therapy and major drug combinations among diabetic patients (n = 610)

Antidiabetic therapy pattern	Number (%)
Single-drug therapy	206 (33.77)
Metformin alone	154 (25.25)
Insulin alone	52 (8.52)
Two-drug combination therapy	280 (45.90)
Metformin + Glibenclamide	123 (20.16)
Insulin + Metformin	60 (9.84)
Metformin + Glimepiride	41 (6.72)
Metformin + Glipizide	39 (6.40)
Metformin + Voglibose	6 (0.98)
Metformin + Pioglitazone	5 (0.82)
Metformin + Acarbose	5 (0.82)
Insulin + Glimepiride	1 (0.16)
Three-drug combination therapy	123 (20.16)
Metformin + Glibenclamide + Pioglitazone	52 (8.52)
Insulin + Metformin + Glibenclamide	19 (3.11)
Metformin + Glipizide + Pioglitazone	17 (2.79)
Metformin + Glimepiride + Pioglitazone	12 (1.98)
Insulin + Metformin + Glipizide	9 (1.47)
Insulin + Metformin + Glimepiride	7 (1.15)
Other three-drug combinations	7 (1.14)
Four-drug combination therapy	1 (0.17)
Insulin + Metformin + Glimepiride + Pioglitazone	1 (0.17)

[Table 4] shows that, the two-drug combination therapy was the most common treatment pattern, observed in 280 (45.90%) patients, followed by single-drug therapy in 206 (33.77%) and three-drug therapy in 123 (20.16%) patients. Metformin alone was the most common monotherapy, prescribed in 154 (25.25%) patients. Among two-drug combinations, metformin with glibenclamide was the most

frequent combination, used in 123 (20.16%) patients, followed by insulin with metformin in 60 (9.84%) patients. Among three-drug regimens, metformin with glibenclamide and pioglitazone was the most common combination, observed in 52 (8.52%) patients. Four-drug therapy was rarely prescribed and was documented in only 1 (0.17%) patient.

Table 5: ATC classification, PDD, DDD, and PDD:DDD ratio of antidiabetic drugs

Drug	ATC code	PDD	DDD	PDD:DDD ratio
Insulin	A10AD30	33.38 IU	40 IU	0.8345
Metformin	A10BA02	1.33 g	2 g	0.665
Glibenclamide	A10BB01	9.25 mg	10 mg	0.925
Glimepiride	A10BB12	3.84 mg	2 mg	1.920
Glipizide	A10BB07	9.77 mg	10 mg	0.977
Pioglitazone	A10BG03	24.13 mg	30 mg	0.8043
Acarbose	A10BF01	0.30 g	0.30 g	1.000

As depicted in [Table 5], the PDD:DDD ratio was below 1 for insulin, metformin, glibenclamide, glipizide, and pioglitazone, suggesting that the prescribed daily doses were lower than the defined daily doses for most agents. Glimepiride showed the highest PDD:DDD ratio of 1.920, indicating a higher prescribed dose in relation to its defined daily dose. Acarbose had a PDD:DDD ratio of 1.000, showing equivalence between prescribed and defined daily doses. Overall, the PDD:DDD pattern indicated variation in dose utilization across different antidiabetic drugs.

DISCUSSION

This study highlights key prescribing trends among 610 diabetic patients attending the diabetic clinic and medicine outpatient department of a tertiary care hospital. The majority of patients were in the 46–60 years age group, with a mean age of 51.74 ± 12.51 years, and type 2 diabetes mellitus accounted for 95.41% of cases. A slight female predominance was observed. Similar sex distribution was reported by Kumar MA et al,^[10] and Das P et al,^[11] while Patel B et al,^[12] reported a slightly higher mean age than the present study. More than half of the patients had diabetes for more than five years, indicating a chronic disease profile requiring sustained pharmacological care and periodic treatment intensification.

BMI assessment showed that overweight was the most frequent category, while a considerable proportion of patients were obese. This pattern supports the well-established association between excess body weight, insulin resistance, and type 2 diabetes mellitus. Hypertension was the most common comorbidity, observed in 42.13% of patients, which was comparable to the findings of Jimoh AO et al.^[13] The frequent coexistence of hypertension and diabetes explains the need for concomitant cardiovascular medications and highlights the importance of integrated risk-factor management in diabetic outpatient care.

The prescription burden indicated moderate polypharmacy, with an average of 1.86 ± 0.70 antidiabetic drugs and 3.37 ± 2.00 total drugs per encounter. More than half of the patients received three or more total drugs. Kannan et al.^[14] reported fewer antidiabetic drugs per encounter, whereas Acharya KG et al,^[15] reported a higher average number of total drugs. Such variation may be related to differences in comorbidities, disease duration, drug availability, and institutional prescribing practices. In the present study, generic prescribing was 48.90%, while brand-name prescribing was slightly higher at 51.10%. Although 75.00% of drugs were included in the National Essential Medicine List, the relatively lower generic prescribing suggests further scope

for improving cost-effective prescribing.

Metformin was the most frequently prescribed antidiabetic drug, followed by sulphonylureas and insulin. This finding is consistent with Patel B et al,^[12] and Yusefzadeh G et al,^[16] who also reported predominant use of biguanides, whereas Kumar MA et al,^[10] observed sulphonylureas as the commonest drug class. Two-drug combination therapy was the most common treatment pattern, with metformin plus glibenclamide being the leading combination. A similar combination pattern was reported by Guidoni CM et al,^[17] while Patel B et al,^[12] reported metformin plus glimepiride as the commonest two-drug regimen. These findings suggest that metformin-based therapy remained the central component of diabetes management in the present study. The PDD:DDD analysis showed variation in dose utilization across antidiabetic drugs. Most drugs had PDD:DDD ratios below 1, while glimepiride showed the highest ratio, indicating a prescribed daily dose higher than the defined daily dose. Acarbose showed equivalence between prescribed and defined daily doses. However, DDD is a technical drug-utilization unit and does not necessarily represent the ideal therapeutic dose for every patient; therefore, PDD:DDD ratios should be interpreted with clinical context, including disease severity, glycaemic response, comorbidities, and prescriber judgment.

CONCLUSION

In conclusion, the present study demonstrated a metformin-dominant prescribing pattern, frequent use of combination therapy, moderate polypharmacy, and substantial use of concomitant cardiovascular medications among diabetic outpatients. The prescribing pattern was broadly rational, particularly with good representation of drugs from the National Essential Medicine List; however, generic prescribing remained suboptimal. Regular prescription audits, greater promotion of generic medicines, cost-conscious prescribing, and periodic review of antidiabetic combinations may further improve rational drug use and reduce the long-term financial burden among diabetic patients.

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Conflicts of interest

There are no conflicts of interest.

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