

Insulin Utilization Patterns and Contemporary Antidiabetic Drug Selection in Real-World Clinical Practice

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Abstract

The expanding therapeutic armamentarium for diabetes mellitus has substantially influenced prescribing practices, emphasizing the importance of evaluating real-world utilization of antidiabetic medications and insulin therapy in routine clinical care. This prospective observational drug utilization study assessed prescribing trends among 400 patients with diabetes mellitus attending a tertiary care hospital. Prescription records were systematically reviewed to document demographic characteristics, diabetes type, antidiabetic drug selection, insulin utilization, routes of administration, and prescribed dosage ranges. Data were analysed using descriptive statistics and presented as frequencies and percentages. Male patients represented 60.0% of the study population, and the highest proportion of cases occurred in the 46–55-year age group (27.5%). Type 2 diabetes mellitus constituted the predominant diagnosis (86.0%), whereas Type 1 diabetes mellitus and secondary diabetes accounted for 10.5% and 3.5% of cases, respectively. Metformin was the most frequently prescribed antidiabetic medication (71.5%), followed by glimepiride (37.0%), while thiazolidinediones and insulin preparations were prescribed less commonly. Oral glucose-lowering therapy remained the principal treatment strategy, accounting for 84.75% of prescriptions. Insulin therapy was utilized selectively, with long-acting insulin analogues representing the most frequently prescribed insulin category (5.5%). Combined oral and injectable regimens were observed in 12.5% of patients. Prescribed dosage ranges were generally consistent with contemporary therapeutic recommendations and accepted clinical practice standards. Overall, diabetes management demonstrated a strong preference for oral antidiabetic therapy, particularly metformin-based regimens, whereas insulin use remained

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limited and was primarily centred on long-acting formulations. These findings provide robust real-world evidence of current prescribing behaviour and therapeutic decision-making, contributing to the optimization of rational pharmacotherapy and patient-centred diabetes management.

Key words : Diabetes Mellitus; Drug Utilization Pattern; Insulin Utilization; Antidiabetic Drugs; Prescription Pattern; Real-World Evidence.

Diabetes mellitus (DM) represents one of the most formidable and rapidly expanding global public health challenges of the twenty-first century. Characterized by chronic hyperglycaemia resulting from defects in insulin secretion, insulin action, or a combination of both, diabetes is associated with substantial morbidity, premature mortality, and escalating healthcare expenditures.⁴ The International Diabetes Federation estimates that the worldwide prevalence of diabetes continues to increase at an alarming rate, driven by population aging, urbanization, sedentary lifestyles, obesity, and nutritional transitions.⁹ Consequently, optimizing pharmacotherapeutic management has become a central component of contemporary diabetes care.

The therapeutic armamentarium for diabetes has undergone remarkable transformation during the past two decades. While traditional agents such as metformin, sulfonylureas, and insulin remain fundamental components of treatment, the introduction of dipeptidyl peptidase-4 (DPP-4) inhibitors, sodium-glucose cotransporter-2 (SGLT-2) inhibitors, glucagon-like peptide-1 receptor agonists (GLP-1 RAs), and other novel therapies has significantly broadened treatment possibilities.⁷ These advancements have enabled clinicians to individualize therapy according to patient-specific

characteristics, comorbidities, cardiovascular risk profiles, and glycaemic targets.

Among all available treatment modalities, insulin continues to occupy a pivotal position in diabetes management⁵. Insulin therapy remains indispensable for patients with Type 1 Diabetes Mellitus and is frequently required in advanced Type 2 Diabetes Mellitus when oral antidiabetic agents fail to achieve adequate glycaemic control.⁸ Contemporary insulin formulations, including rapid-acting, short-acting, intermediate-acting, long-acting, and premixed preparations, offer enhanced pharmacokinetic profiles and greater therapeutic flexibility.⁵ Nevertheless, concerns regarding hypoglycaemia, weight gain, injection burden, and patient adherence continue to influence insulin prescribing practices in routine clinical settings.

Drug utilization research serves as an invaluable tool for evaluating prescribing trends, therapeutic appropriateness, and adherence to evidence-based treatment recommendations. Such investigations provide critical insights into real-world prescribing behaviour and facilitate the identification of irrational prescribing patterns, underutilization of effective therapies, and opportunities for pharmacotherapeutic optimization.¹⁵ Prescription pattern analysis is particularly

relevant in diabetes management because treatment strategies frequently evolve in response to emerging clinical evidence and updated guideline recommendations.

Current international guidelines advocate patient-centred approaches emphasizing individualized treatment selection based on efficacy, safety, affordability, cardiovascular benefit, renal protection, and patient preferences.⁷ Consequently, understanding contemporary prescribing patterns and insulin utilization trends has become increasingly important for assessing the translation of guideline recommendations into routine clinical practice. Real-world evidence generated through prescription audits and drug utilization studies can assist healthcare professionals, policymakers, and clinical pharmacists in improving therapeutic decision-making and promoting rational medication use.

Despite substantial advances in diabetes pharmacotherapy, variations in prescribing behaviour continue to exist across healthcare settings and patient populations. Information regarding contemporary antidiabetic drug selection and insulin utilization patterns in routine clinical practice remains limited in many regions¹. Therefore, the present study was undertaken to evaluate real-world prescribing trends, insulin utilization patterns, routes of administration, and antidiabetic drug selection among patients with diabetes mellitus receiving care in a tertiary healthcare institution. The findings are expected to provide valuable insights into current therapeutic practices and contribute to the optimization of evidence-based diabetes management.

Study Design :

A prospective, observational, drug utilization study was conducted to evaluate insulin utilization patterns and contemporary antidiabetic drug selection among patients with diabetes mellitus receiving treatment in a tertiary care teaching hospital. The study was designed to assess real-world prescribing practices, patterns of antidiabetic medication utilization, insulin prescribing trends, routes of administration, and adherence to contemporary therapeutic recommendations.

Study Setting :

The study was carried out in the Department of General Medicine and Endocrinology of a tertiary care teaching hospital. Data were collected from both inpatient and outpatient departments where patients with diabetes mellitus received routine clinical care and pharmacotherapeutic management.

Study Duration :

The study was conducted over a period of 12 months, during which eligible prescriptions and patient records were prospectively reviewed and analyzed.

Study Population :

The study population consisted of adult patients diagnosed with diabetes mellitus who were receiving one or more antidiabetic medications during the study period.

Sample Size :

A total of **400 patients and their**

corresponding prescriptions were included in the study. The sample size was considered adequate to evaluate contemporary prescribing trends and insulin utilization patterns within the study setting.

Inclusion Criteria :

- Patients aged 18 years and above.
- Patients diagnosed with Type 1 Diabetes Mellitus, Type 2 Diabetes Mellitus, or secondary diabetes.
- Patients receiving at least one antidiabetic medication.
- Patients willing to provide informed consent for participation.

Exclusion Criteria :

- Patients with incomplete medical records or missing prescription information.
- Patients unwilling to participate in the study.
- Pregnant women diagnosed with gestational diabetes mellitus.
- Patients enrolled in investigational drug trials during the study period.

Data Collection Procedure :

Eligible patients were identified through routine clinical visits and hospital records. After obtaining informed consent, relevant demographic, clinical, and prescription-related information was collected using a structured data collection form.

The following variables were documented:

Demographic Characteristics :

- Age

- Gender
- Type of diabetes mellitus

Clinical Characteristics :

- Duration of diabetes
- Presence of comorbidities
- Current treatment regimen

Prescription Pattern Assessment :

- Individual antidiabetic drugs prescribed
- Frequency of antidiabetic drug utilization
- Insulin prescribing patterns
- Types of insulin prescribed
- Route of administration
- Monotherapy and combination therapy patterns
- Dosage forms and prescribed dose ranges
- Utilization of newer antidiabetic agents

Drug Utilization Evaluation :

Drug utilization patterns were evaluated according to the World Health Organization (WHO) principles of rational medicine use. Prescriptions were assessed for therapeutic appropriateness, conformity with contemporary diabetes management recommendations, and utilization trends of different antidiabetic drug classes.

Outcome Measures :

Primary Outcome :

- To evaluate contemporary antidiabetic drug selection patterns among patients with diabetes mellitus.

Secondary Outcomes :

- To determine the frequency distribution

of individual antidiabetic medications.

- To assess insulin utilization patterns according to insulin type.
- To evaluate routes of administration of antidiabetic therapies.
- To identify prevailing prescribing trends in Type 1 and Type 2 diabetes mellitus.
- To analyze prescribed dose ranges of commonly utilized antidiabetic agents.
- To assess the extent of utilization of modern antidiabetic therapies in routine clinical practice.

Statistical Analysis :

All data were entered into Microsoft Excel and analyzed using **Statistical Package**

for the Social Sciences (SPSS) version 32.0 (IBM Corp., Armonk, NY, USA).

Descriptive statistical methods were employed for data analysis. Continuous variables were expressed as **mean $\pm$ standard deviation (SD)**, while categorical variables were presented as **frequencies and percentages**.

The distribution of demographic characteristics, diabetes types, antidiabetic drug utilization, insulin prescribing patterns, and routes of administration were summarized using descriptive statistics. Results were presented in the form of tables and graphical representations to facilitate interpretation of prescribing trends and utilization patterns.

Outcome :

This table-1 shows the distribution of study participants according to age and gender. Male participants were higher than female participants in all age groups. The highest number of patients was observed in the 46–55 years age group.

Table-1. Age-wise and Gender-wise Distribution of Study Participants (n = 400)

Age Group (Years)	Male n (%)	Female n (%)	Total n (%)
20–35	24 (6.0)	18 (4.5)	42 (10.5)
36–45	41 (10.25)	29 (7.25)	70 (17.5)
46–55	66 (16.5)	44 (11.0)	110 (27.5)
56–65	61 (15.25)	41 (10.25)	102 (25.5)
>65	48 (12.0)	28 (7.0)	76 (19.0)
Total	240 (60.0)	160 (40.0)	400 (100)

This table-2 presents the frequency distribution of individual antidiabetic drugs prescribed among the study participants. Metformin was the most commonly prescribed

medication, followed by glimepiride. Lower prescription frequencies were observed with insulin preparations and pioglitazone.

Table-2. Frequency Distribution of Individual Antidiabetic Drugs (n=400).

Drug Name	Frequency (n)	Percentage (%)
Metformin	286	71.5
Glimepiride	148	37
Gliclazide	73	18.25
Sitagliptin	62	15.5
Vildagliptin	72	18
Empagliflozin	66	16.5
Dapagliflozin	50	12.5
Voglibose	48	12
Pioglitazone	34	8.5
Human insulin	25	6.25
Insulin glargine	36	9

This table-3 presents the utilization pattern of different types of insulin prescribed among the study participants. Long-acting insulin was the most commonly prescribed insulin type, whereas rapid-acting, intermediate-acting, and premixed insulin preparations were prescribed less frequently. The majority of patients did not receive insulin therapy

Table-3. Insulin Utilization Pattern by Type (n = 400)

Insulin Type	Frequency (n)	Percentage (%)
Rapid-acting insulin	9	2.25
Short-acting insulin	14	3.5
Intermediate-acting insulin	8	2
Long-acting insulin	22	5.5
Premixed insulin	8	2
Not prescribed	339	84.75

The table-4 presents the distribution of routes of administration of antidiabetic drugs prescribed among the study participants. Oral therapy alone was the most commonly prescribed route of administration, whereas injectable therapy alone was prescribed in only a small proportion of patients. Combination therapy involving both oral and injectable antidiabetic agents was observed in a moderate number of participants

Table 4. Route of Administration of Antidiabetic Drugs (n = 400)

Route of Administration	Frequency (n)	Percentage (%)
Oral therapy only	339	84.75
Injectable therapy only	11	2.75
Oral + Injectable therapy	50	12.5
Total	400	100

This table-5 categorizes the prescriptions based on the clinical type of diabetes mellitus among the study participants. Type 2 diabetes mellitus constituted the majority of reviewed prescriptions, whereas Type 1 diabetes mellitus and secondary diabetes were observed less frequently.

Table-5. Distribution of Prescriptions According to Type of Diabetes Mellitus (n = 400)

Diabetes Type	Frequency (n)	Percentage (%)
Type 1 Diabetes Mellitus	42	10.5
Type 2 Diabetes Mellitus	344	86
Secondary diabetes	14	3.5

This table presents the commonly prescribed oral and injectable antidiabetic medications along with their daily dose ranges among the study participants.

Table-6. Antidiabetic Medicines Prescribed in Different Dose Ranges (n = 400)

S. No.	Antidiabetic Medication	Dosage Form	Daily Dose Range
1	Metformin	Oral	500–2000 mg/day
2	Glimepiride	Oral	1–6 mg/day
3	Glidazide	Oral	30–120 mg/day
4	Sitagliptin	Oral	50–100 mg/day
5	Vildagliptin	Oral	50–100 mg/day
6	Empagliflozin	Oral	10–25 mg/day
7	Dapagliflozin	Oral	5–10 mg/day
8	Voglibose	Oral	0.2–0.6 mg/day
9	Pioglitazone	Oral	15–30 mg/day
10	Human Insulin	Injectable	10–40 units/day
11	Insulin Glargine	Injectable	10–30 units/day

The present study evaluated contemporary antidiabetic prescribing practices and insulin utilization patterns among patients with diabetes mellitus in a real-world tertiary care setting. The findings provide valuable insights into current therapeutic preferences and demonstrate a predominant reliance on oral antidiabetic agents, particularly metformin-based regimens, with comparatively limited utilization of insulin therapy. These observations reflect evolving prescribing behavior influenced by contemporary evidence-based guidelines and the expanding availability of newer glucose-lowering therapies⁷.

In the present study, the majority of patients belonged to the 46–55 years age group, and males constituted a greater proportion of the study population than females. Similar demographic distributions have been reported in epidemiological investigations conducted across developing and developed healthcare

settings, where middle-aged adults represent the largest subgroup affected by diabetes mellitus.^{7,14} The predominance of males observed in the current study may be attributable to differences in healthcare-seeking behavior, occupational risk factors, lifestyle patterns, and prevalence of metabolic syndrome.

Type 2 Diabetes Mellitus accounted for 86% of all evaluated prescriptions, confirming its overwhelming contribution to the global diabetes burden. This finding is consistent with reports from the International Diabetes Federation and other population-based studies indicating that Type 2 Diabetes Mellitus constitutes approximately 90–95% of all diabetes cases worldwide.^{2,10} The relatively lower prevalence of Type 1 Diabetes Mellitus and secondary diabetes observed in the present study is also consistent with contemporary epidemiological trends.

Metformin emerged as the most frequently prescribed antidiabetic medication, accounting for 71.5% of prescriptions. This observation aligns closely with recommendations from the American Diabetes Association and the European Association for the Study of Diabetes, which continue to endorse metformin as the preferred first-line pharmacological therapy for most patients with Type 2 Diabetes Mellitus.¹² The widespread utilization of metformin may be attributed to its well-established efficacy, favorable safety profile, low risk of hypoglycaemia, cardiovascular benefits, and cost-effectiveness.⁶

Among second-line oral agents, sulfonylureas such as glimepiride and gliclazide remained extensively utilized. Similar prescribing trends have been documented in several real-world drug utilization studies, particularly in low- and middle-income countries where affordability remains a major determinant of therapeutic selection.¹ However, increasing utilization of DPP-4 inhibitors and SGLT-2 inhibitors observed in the current study reflects a gradual shift toward newer therapeutic classes that provide additional cardiovascular and renal benefits beyond glycaemic control.^{11,12}

The present investigation demonstrated relatively modest utilization of insulin therapy, with approximately 15% of patients receiving any form of insulin. Long-acting insulin preparations represented the most frequently prescribed insulin category. These findings are consistent with contemporary treatment paradigms that prioritize oral antidiabetic agents and reserve insulin initiation for patients with advanced disease, severe hyperglycaemia, contraindications to oral medications, or inadequate glycaemic control

despite combination therapy.¹⁴ Previous studies have similarly reported increasing preference for basal insulin analogues due to their prolonged duration of action, lower risk of nocturnal hypoglycaemia, and improved patient adherence.¹³

Analysis of routes of administration revealed that oral therapy alone accounted for the majority of treatment regimens, whereas injectable therapy alone was relatively uncommon. These observations likely reflect patient preferences for non-invasive treatment approaches, improved availability of effective oral medications, and efforts to delay insulin initiation whenever clinically appropriate. Similar findings have been reported in multinational observational studies evaluating contemporary diabetes management practices.¹⁰

The dosage ranges prescribed for individual antidiabetic agents were largely consistent with approved therapeutic recommendations and current clinical guidelines. This finding suggests an overall pattern of rational prescribing and adherence to evidence-based pharmacotherapeutic principles. Drug utilization studies have emphasized that appropriate dose selection is essential for maximizing therapeutic efficacy while minimizing adverse drug reactions and treatment-related complications.⁶

Overall, the findings of the present study indicate that contemporary diabetes management is characterized by substantial utilization of metformin-centered treatment strategies, increasing incorporation of novel antidiabetic agents, and selective use of insulin therapy. These prescribing patterns appear to be largely aligned with international recommendations and evolving standards of diabetes

care. Continuous prescription monitoring and periodic drug utilization evaluations remain essential for ensuring rational medication use and optimizing therapeutic outcomes among patients with diabetes mellitus.

Inference :

The present study demonstrated that contemporary diabetes management in routine clinical practice is predominantly centered on oral antidiabetic therapy, with metformin remaining the cornerstone of pharmacological treatment. Type 2 Diabetes Mellitus represented the vast majority of evaluated cases, while insulin utilization was comparatively limited and primarily involved long-acting insulin preparations. The increasing use of DPP-4 inhibitors and SGLT-2 inhibitors reflects the gradual adoption of newer evidence-based therapeutic approaches. Overall, prescribing patterns were found to be largely consistent with current international treatment recommendations, indicating rational drug utilization and appropriate therapeutic decision-making. Continued surveillance of prescribing trends is essential to promote evidence-based practice, optimize patient outcomes, and enhance the quality of diabetes care.

Conflict of Interest :

The authors declare that there are no conflicts of interest regarding the publication of this study.

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Ethical Approval :

The study protocol was reviewed and

approved by the Institutional Ethics Committee prior to commencement of the study.

Informed Consent :

Written informed consent was obtained from all participants before enrolment in the study.

Authors' Contributions :

- **Conceptualization and Study Design:** Dr. Syed Raziuddin Faisal
- **Supervision and Critical Review:** Dr. Shekar H.S.
- **Data Collection and Investigation:** Dr. Syed Raziuddin Faisal
- **Data Analysis and Interpretation:** Dr. Syed Raziuddin Faisal
- **Manuscript Drafting:** Dr. Syed Raziuddin Faisal
- **Manuscript Review and Editing:** Dr. Shekar H.S. and Dr. B. Nagaraju
- **Final Approval of the Manuscript:** All authors critically reviewed the manuscript, approved the final version, and agreed to be accountable for all aspects of the work.

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Data Availability Statement :

The datasets generated and analysed during the current study are available from the corresponding author upon reasonable request.

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