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Prescription patterns of antidiabetic medications in adults with type 2 diabetes mellitus at a tertiary care teaching hospital in Navi Mumbai, India: a cross-sectional observational study.

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Abstract

Background:
Prescription-pattern studies provide real-world evidence on the use of glucose-lowering medicines and may identify changes in clinical practice as treatment options expand. This study assessed oral antidiabetic agents, insulin preparations, and metformin-based combinations prescribed to adults with type 2 diabetes mellitus in a tertiary-care outpatient setting.

Methods:
A cross-sectional observational study was conducted in the Departments of Medicine and Pharmacology at D Y Patil Hospital and Research Centre, Nerul, Navi Mumbai, Maharashtra, India, from April to July 2026. Adults with type 2 diabetes mellitus receiving antidiabetic therapy were selected consecutively. Demographic, diagnostic, and prescription data were recorded using a predesigned case-record form and summarized using descriptive statistics.

Results:
A total of 102 participants were included and analyzed. Adults aged 25-64 years constituted 69 (67.64%) participants; 55 (53.92%) were female, and 49 (48.04%) had type 2 diabetes mellitus with complications. Concomitant non-antidiabetic medicines accounted for 51.96% of medication use and antidiabetic medicines for 48.04%. Metformin-based dual therapy was the most frequent oral regimen (33.2%), followed by triple therapy (16.8%). Dipeptidyl peptidase-4 inhibitor plus metformin was the leading metformin combination (42 prescriptions), followed by sodium-glucose cotransporter-2 inhibitor-dipeptidyl peptidase-4 inhibitor-metformin triple therapy (33 prescriptions). Among 31 insulin prescriptions, insulin glargine was most frequent (18; 58.1%), followed by biphasic human insulin (11; 35.5%) and regular insulin (2; 6.5%).

Conclusions:
The prescribing pattern was centered on metformin-based combination therapy, with substantial use of dipeptidyl peptidase-4 and sodium-glucose cotransporter-2 inhibitors and a preference for basal insulin. Periodic prescription audits linked to clinical outcomes are required to assess appropriateness, affordability, and long-term effectiveness.

Recommendations:
Regular prescription audits should evaluate guideline adherence, affordability, glycaemic outcomes, adverse effects, and rational use of combination therapy and insulin.

Keywords: *type 2 diabetes mellitus; antidiabetic prescribing pattern; drug utilization; oral antidiabetic agents; metformin combination therapy; insulin glargine; dipeptidyl peptidase-4 inhibitors; sodium-glucose cotransporter-2 inhibitors.*
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Introduction

Type 2 diabetes mellitus (T2DM) is a chronic metabolic disorder characterized by insulin resistance and progressive beta-cell dysfunction, resulting in persistent hyperglycaemia and increased risks of microvascular and macrovascular complications. India carries a substantial and heterogeneous burden of diabetes and related metabolic non-communicable diseases [1].

Effective management requires individualized lifestyle measures and pharmacotherapy selected according to glycaemic status, comorbidities, complication risk, treatment burden, safety, and access. Contemporary guidance supports metformin and other oral or injectable glucose-lowering medicines, including sodium-glucose cotransporter-2 (SGLT2) inhibitors, dipeptidyl peptidase-4 (DPP-4) inhibitors, and insulin, according to patient-specific needs [2,3].

The expanding range of antidiabetic medicines has increased the complexity of treatment selection. Periodic prescription audits can identify real-world utilization trends, characterize monotherapy and combination therapy, and support rational prescribing. Recent hospital-based studies in India have demonstrated continuing metformin use alongside increasing therapeutic diversification [4,5].

Tertiary care teaching hospitals manage patients with varied disease duration, complications, and comorbidities and are therefore useful settings for evaluating antidiabetic prescribing practices. The present study examined current patterns of oral antidiabetic therapy, insulin use, and metformin-based combinations in such a setting.

Aim and Objectives

The aim was to analyze the prescription pattern of antidiabetic medications among adults with T2DM attending a tertiary care teaching hospital. The objectives were to evaluate the use of oral antidiabetic agents, analyze the utilization of insulin preparations, and assess monotherapy and combination therapy involving oral agents and/or insulin.

Methods

Study Design and Setting

A cross-sectional observational study was conducted from April to July 2026 in the Departments of Medicine and Pharmacology at D Y Patil Hospital and Research Centre, Nerul, Navi Mumbai, Maharashtra, India. The institution is a 1,550-bed multispecialty charitable tertiary-care teaching hospital providing primary-to-tertiary clinical care, emergency and intensive-care services, specialty and superspecialty services, and round-the-clock laboratory and radiology support. Participants were recruited from the outpatient diabetes services of the Department of Medicine.

Study Population

Adults aged 18 years or older with a diagnosis of T2DM, with or without associated comorbidities, who attended the outpatient diabetes clinic and were receiving antidiabetic therapy were eligible. Consecutive sampling was used: every potentially eligible patient presenting during the study period was screened against the predefined eligibility criteria. Patients who provided written informed consent and had complete clinical and prescription records were included. Patients who declined participation or had incomplete medical records were excluded.

Study Size

The study was designed as a descriptive prescription-pattern audit; therefore, an inferential power-based sample size calculation was not used. Instead, complete consecutive inclusion was applied throughout the predefined four-month data-collection period. Of 111 potentially eligible patients screened, 9 did not enter the final analysis because they either declined participation or had incomplete records, leaving 102 eligible participants for inclusion and analysis.

Data Collection

A photocopy or digital photograph of each prescription was retained for record maintenance. Data were entered into a predesigned case-record form and included age, sex, provisional or confirmed diagnosis, complications, and details of all prescribed medicines. Prescriptions generated by interns, postgraduate residents, consultants, and faculty members were included. Patient confidentiality was maintained throughout the study.

Study Variables and Outcomes

The principal outcomes were the distribution of oral antidiabetic regimens, insulin preparations, metformin-based dual and triple combinations, and concomitant non-antidiabetic medicines. Demographic and diagnostic characteristics were also summarized.

Bias and Bias Minimization

Potential selection bias was minimized by applying predefined eligibility criteria uniformly to all prescriptions screened during the study period. Information and transcription bias were reduced by collecting data directly from retained prescription copies or digital images using a standardized case-record form. Drug names, combinations, diagnoses, and patient characteristics were cross-checked

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against the original prescription before analysis. Prescriptions from different categories of prescribers were included to improve representativeness and reduce prescriber-selection bias. Incomplete records were excluded according to predefined criteria. As the study was conducted at a single tertiary-care hospital, the findings may not be generalizable to other healthcare settings.

Statistical Analysis

Descriptive statistics were used for analysis. Categorical variables were summarized as frequencies and percentages. Continuous variables, when applicable, were summarized using means with standard deviations or medians with appropriate measures of dispersion. As the study objective was descriptive and no between-group hypothesis testing was planned, inferential p-values were not calculated.

Ethical Considerations

The study was conducted after approval from the Institutional Ethics Committee and in accordance with the principles of the International Council for Harmonisation-Good Clinical Practice. Written informed consent was obtained, and confidentiality was maintained. Ethics approval number: IEC Ref. No: DYP/IECBH/2026/62

Results

During the study period, 111 potentially eligible adults with T2DM were identified and examined for eligibility. Nine were excluded because they either declined participation or had incomplete medical records. The remaining 102 participants met the eligibility criteria, were included in the study, and all 102 were analyzed. The final analytical sample was therefore 102 participants.

Participant Flow

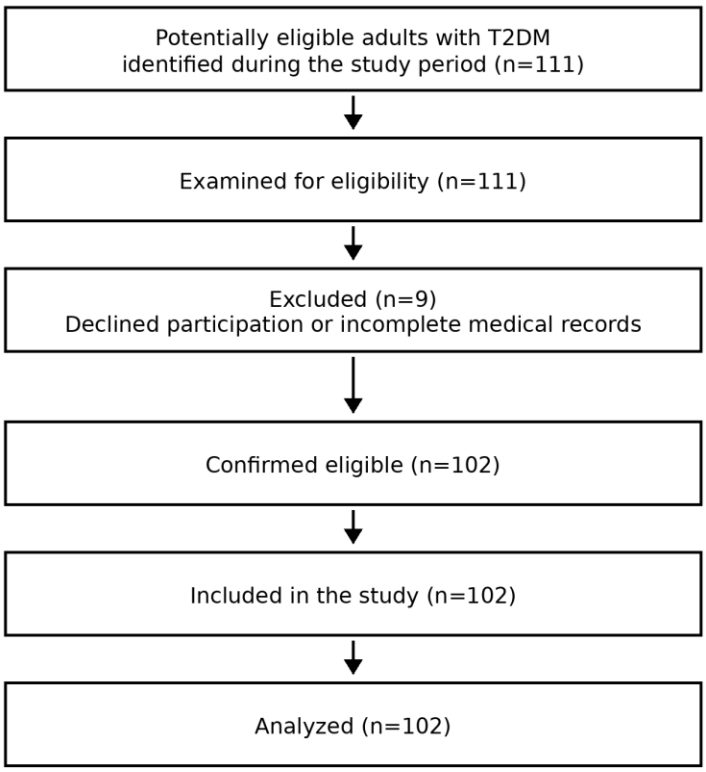

Table 1. Demographic and clinical characteristics of the study population (n=102).

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Characteristic	Category	n (%)
Age	Young adult (19-24 years)	0 (0.00)
	Adult (25-64 years)	69 (67.64)
	Elderly (>65 years)	33 (32.36)
Sex	Male	47 (46.07)
	Female	55 (53.92)
Diagnosis	T2DM without complications	53 (51.96)
	T2DM with complications	49 (48.04)

As shown in Table 1, the total study population comprised 102 participants. Adults aged 25-64 years formed the largest group (69/102; 67.64%), followed by participants older than 65 years (33/102; 32.36%); no participant was aged 19-24 years. Females accounted for 55 (53.92%) participants and males for 47 (46.07%), together representing the complete sample. T2DM without documented complications was present in 53 (51.96%) participants, whereas 49 (48.04%) had T2DM with complications.

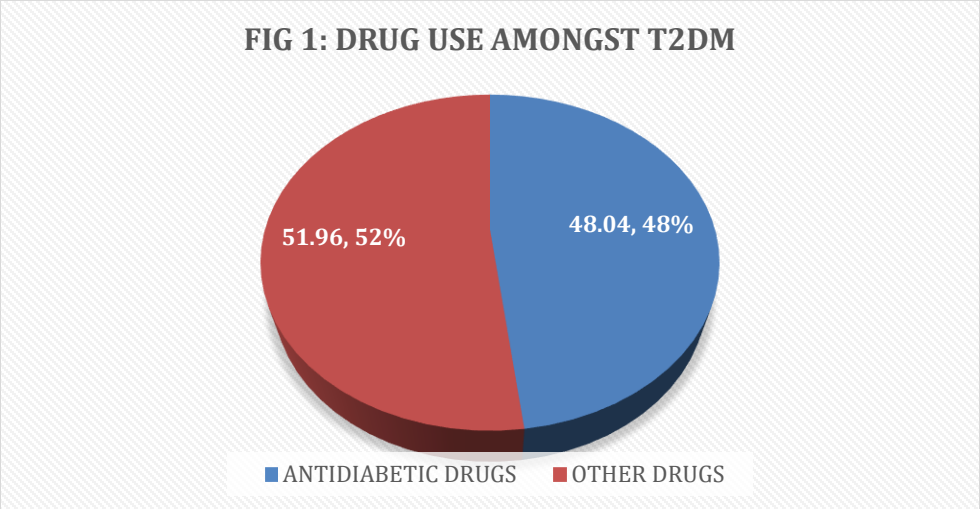

Figure 1. Overall distribution of prescribed medications.

As illustrated in Fig 1, the concomitant non-antidiabetic medicines constituted 51.96% of medication use, whereas antidiabetic medicines accounted for 48.04%. Metformin-based dual therapy was the most frequently recorded oral treatment pattern, followed by metformin-based triple therapy. Metformin monotherapy, sulfonylureas, and DPP-4 inhibitors were recorded equally, while SGLT2 inhibitors and alpha-glucosidase inhibitors were less frequent.

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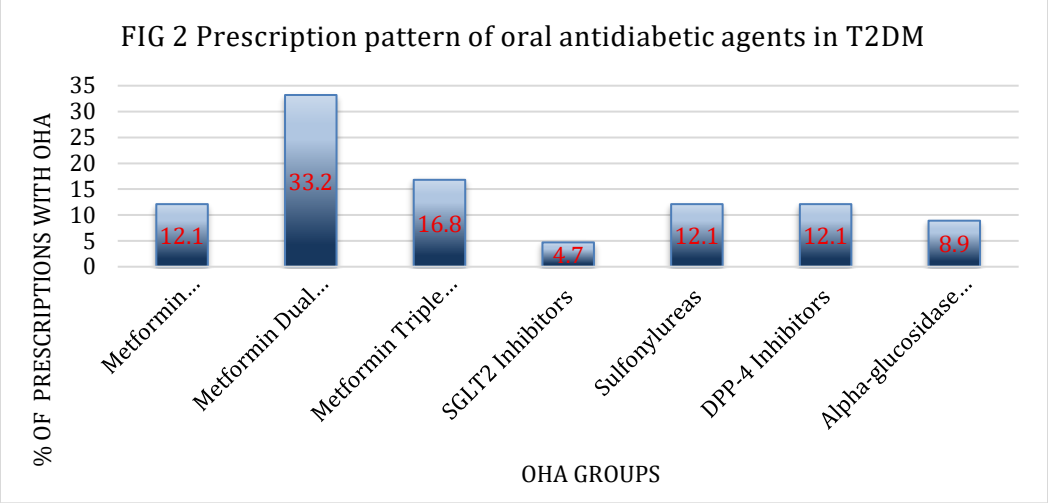

Figure 2. Prescription pattern of oral antidiabetic therapy.

As depicted in Fig 2, metformin-based dual therapy was most frequent (33.2%), followed by metformin-based triple therapy (16.8%). Metformin monotherapy, sulfonylureas, and DPP-4 inhibitors each accounted for 12.1%, while alpha-glucosidase inhibitors and SGLT2 inhibitors accounted for 8.9% and 4.7%, respectively.

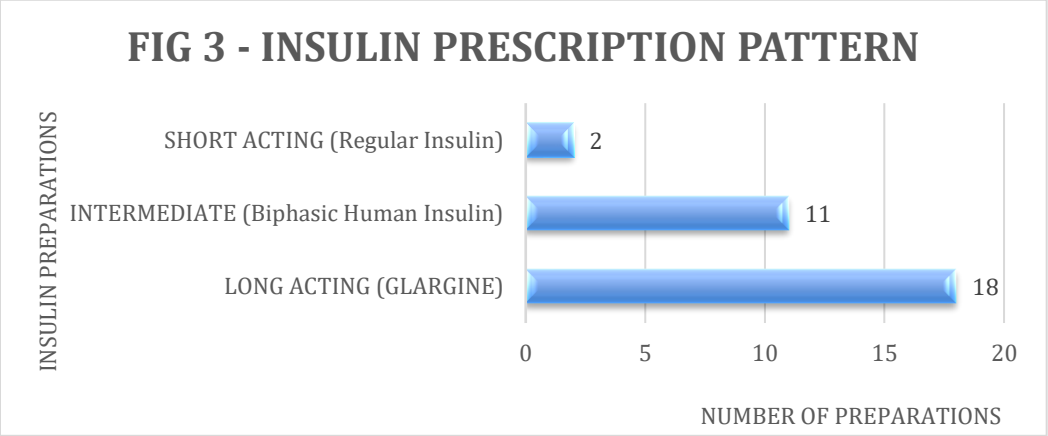

Figure 3. Distribution of prescribed insulin preparations.

As demonstrated in Fig 3, insulin glargine was recorded in 18 prescriptions, biphasic human insulin in 11, and regular insulin in 2.

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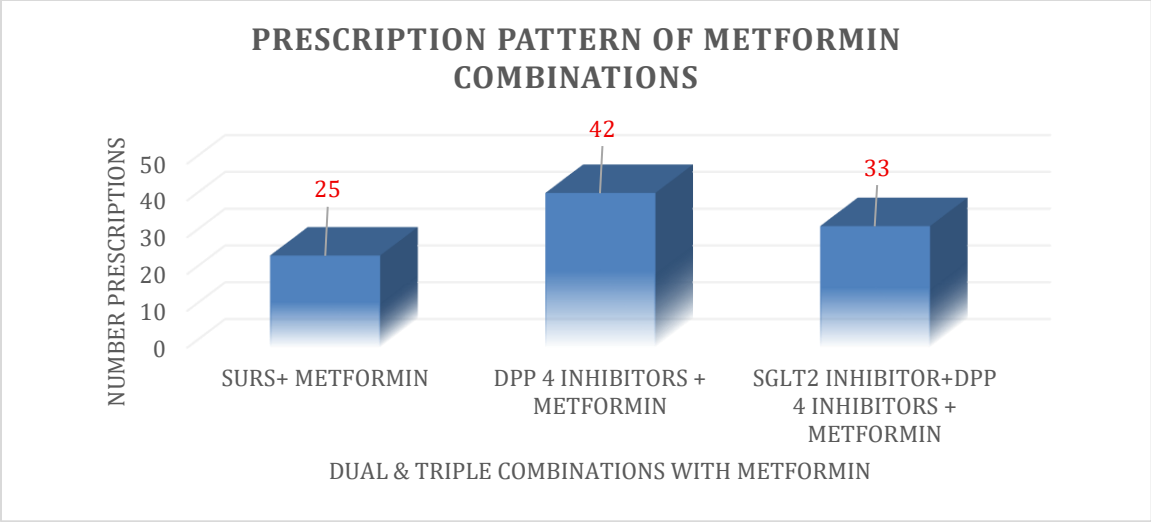

Figure 4. Prescription pattern of metformin-based combinations.

As presented in Fig 4, DPP-4 inhibitor plus metformin occurred in 42 prescriptions, SGLT2 inhibitor-DPP-4 inhibitor-metformin in 33, and sulfonylurea plus metformin in 25. Among the recorded metformin combinations, DPP-4 inhibitor plus metformin was most frequent, followed by SGLT2 inhibitor-DPP-4 inhibitor-metformin triple therapy and sulfonylurea plus metformin.

Discussion

This study identified a clear preference for combination-based glucose-lowering therapy in adults with T2DM attending an urban tertiary-care teaching hospital. Of 102 participants, 69 (67.64%) were aged 25-64 years and 33 (32.36%) were older than 65 years; 55 (53.92%) were female, and 47 (46.07%) were male. T2DM with complications was present in 49 (48.04%) participants, while 53 (51.96%) had no documented complications. This distribution indicates that the prescribing environment involved a largely middle-aged or older population with a substantial burden of established diabetic complications, a profile in which treatment intensification and management of coexisting diseases are commonly required. Butt et al. reported a comparable adult outpatient profile, and the LANDMARC study also documented a substantial burden of diabetes-related complications in routine Indian practice [6,7].

Concomitant non-antidiabetic medicines accounted for 51.96% of total medication use, slightly exceeding antidiabetic medicines (48.04%). This finding suggests that pharmacotherapy in these patients extended beyond glycaemic control and reflected management of associated cardiovascular, renal, lipid, or other comorbid conditions. Such multidrug use is clinically plausible in T2DM because hypertension, dyslipidaemia, vascular disease, and end-organ dysfunction frequently coexist. Similar multidrug treatment patterns were described by Butt et al., while LANDMARC documented frequent cardiovascular, renal, and other diabetes-related complications [6,7].

Among oral antidiabetic regimens, metformin-based dual therapy was most frequent (33.2%), followed by metformin-based triple therapy (16.8%). Metformin monotherapy, sulfonylureas, and dipeptidyl peptidase-4 inhibitors each represented 12.1%, whereas alpha-glucosidase inhibitors and sodium-glucose cotransporter-2 inhibitors accounted for 8.9% and 4.7%, respectively. The predominance of dual and triple therapy indicates that many patients required pharmacological intensification rather than single-agent treatment, while metformin remained the principal foundation for combination therapy. This pattern is consistent with the complementary mechanisms required as beta-cell function declines over time. Tiwari et al., Jha et al., and Brar et al. similarly reported a central role for metformin in contemporary antidiabetic prescribing [4,5,8].

Insulin use also favored a basal strategy. Of 31 recorded insulin preparations, insulin glargine accounted for 18 (58.1%), biphasic human insulin for 11 (35.5%), and regular insulin for 2 (6.5%). The predominance of glargine indicates a preference for sustained basal insulin coverage and a comparatively simple dosing approach in patients requiring injectable treatment. This interpretation aligns with current guidance that supports basal insulin as a practical initial insulin strategy for many adults with T2DM [2].

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Among 100 recorded metformin-based combinations, dipeptidyl peptidase-4 inhibitor plus metformin was most frequent (42; 42%), followed by sodium-glucose cotransporter-2 inhibitor-dipeptidyl peptidase-4 inhibitor-metformin triple therapy (33; 33%) and sulfonylurea plus metformin (25; 25%). The frequency of newer-agent combinations suggests increasing therapeutic diversification and an effort to intensify glycaemic treatment through complementary mechanisms while limiting intrinsic hypoglycaemia. Indian randomized evidence and meta-analysis have demonstrated effective glycaemic intensification with sodium-glucose cotransporter-2 inhibitor, dipeptidyl peptidase-4 inhibitor, and metformin triple therapy [9,10].

Generalizability

The findings may be generalizable primarily to adult patients with T2DM attending comparable urban tertiary-care outpatient clinics in India. However, prescribing practices may differ across primary-care centres, private hospitals, rural settings, and institutions with different formularies, specialist availability, and patient affordability. Therefore, extrapolation to the wider diabetic population should be undertaken cautiously.

Conclusion

This study provides a contemporary overview of antidiabetic prescribing practices among 102 adults with T2DM in a tertiary-care outpatient setting. Most participants were middle-aged or elderly, with a slight female predominance and a substantial burden of complications and concomitant medication use. Metformin remained central to oral therapy and was prescribed mainly in dual and triple combinations. Dipeptidyl peptidase-4 inhibitor-metformin was the most frequently recorded metformin-based regimen, while sodium-glucose cotransporter-2 inhibitor-based triple therapy indicated increasing adoption of newer agents. Long-acting insulin glargine was preferred among insulin preparations. Overall, the findings demonstrate treatment intensification through complementary drug combinations, although clinical appropriateness should be confirmed using patient-level glycaemic, safety, and outcome data.

Limitations

This study has several limitations. It was conducted at a single centre over a relatively short period, which limited the representativeness of the findings. The cross-sectional design captured prescribing practices at one point in time and prevented assessment of temporal changes or causal relationships. Glycaemic indices, treatment adherence, adverse drug reactions, medication costs, and long-term clinical outcomes were not evaluated; therefore, the appropriateness and effectiveness of the prescribed regimens could not be determined. Exclusion of incomplete records introduced a potential source of selection bias. Larger multicentre studies with longitudinal follow-up are required to validate these findings.

Recommendations

Periodic prescription audits should assess adherence to evidence-based treatment guidelines, rationality of combination therapy, medication affordability, and patient safety. Future multicentre studies should incorporate glycaemic control, treatment adherence, adverse drug reactions, cost-effectiveness, and long-term clinical outcomes. Prescribing decisions should remain individualized according to comorbidities, complication status, hypoglycaemia risk, renal function, cardiovascular risk, and patient preferences.

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Abbreviations

DPP-4: Dipeptidyl Peptidase-4
GCP: Good Clinical Practice
IEC: Institutional Ethics Committee
ICH: International Council for Harmonisation
SGLT2: Sodium-Glucose Cotransporter-2
T2DM: Type 2 Diabetes Mellitus

Source of funding

The study had no funding.

Conflict of interest

The authors declare no conflict of interest.

Author Contributions

Dr Masum Reza contributed to data collection, prescription review, literature search, data organization, and preparation of the initial manuscript draft. **Dr Chintan Patel** assisted with participant screening, data collection, data entry, literature review, and manuscript preparation. **Dr Manali Deshpande** contributed to the study methodology, data verification, interpretation of findings, and critical revision of the manuscript. **Dr Vaishali Thakare** conceptualized and

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supervised the study, guided the methodology, validated the data and interpretation, critically revised the manuscript for important intellectual content, and approved the final version for publication.

Data availability

Data Available on request

Author Biographies

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Dr Masum Reza is a third-year Junior Resident in the Department of Pharmacology at D. Y. Patil School of Medicine, Navi Mumbai, Maharashtra, India. He is involved in postgraduate academic activities, pharmacological research, prescription-pattern analysis, and the evaluation of rational medicine use in clinical practice.

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Dr Chintan Patel is a first-year Junior Resident in the Department of Pharmacology at D. Y. Patil School of Medicine, Navi Mumbai, Maharashtra, India. His academic interests include clinical pharmacology, drug-utilization research, pharmacovigilance, and evidence-based prescribing.

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Dr Vaishali Thakare

Dr Vaishali Thakare is Professor in the Department of Pharmacology at D. Y. Patil School of Medicine, Navi Mumbai, Maharashtra, India. She is engaged in undergraduate and postgraduate teaching, research supervision, clinical pharmacology, and the promotion of rational and evidence-based use of medicines. She served as the study supervisor and corresponding author.

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