



PRESCRIPTION PATTERN ANALYSIS IN TERTIARY CARE HOSPITALS: A CROSS-SECTIONAL OBSERVATIONAL STUDY

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ABSTRACT

Background: Prescription pattern analysis is a fundamental pharmacoepidemiological tool for evaluating rational drug use and healthcare quality. Tertiary care hospitals, serving as referral centres for complex cases, are particularly susceptible to polypharmacy and irrational prescribing. This study aimed to assess prescribing patterns using World Health Organization (WHO)/International Network for Rational Use of Drugs (INRUD) core prescribing indicators at a tertiary care teaching hospital.

Methods: A prospective, cross-sectional observational study was conducted over six months (July–December 2025) in the outpatient departments (OPDs) of a tertiary care teaching hospital. A total of 1,200 prescriptions were randomly selected and analysed for WHO/INRUD prescribing indicators including average number of drugs per prescription, percentage prescribed by generic name, percentage from the National List of Essential Medicines (NLEM) 2022, antibiotic encounters, and injectable encounters. Prescription completeness was also evaluated.

Results: The mean number of drugs per prescription was 3.42 (± 1.28). Drugs prescribed by generic name accounted for 58.7% of total prescriptions. NLEM adherence was 73.4%. Antibiotic prescribing was found in 28.6% of encounters, and injectables in 6.8%. Fixed-dose combinations (FDCs) were present in 38.2% of prescriptions. Proton pump inhibitors (pantoprazole) were the most frequently prescribed drug class (61.3%), followed by analgesics, antihypertensives, and antimicrobials. Prescription completeness was 84.3%, with deficiencies noted primarily in diagnosis documentation and prescriber designation.

Conclusion: Prescribing patterns at the study hospital showed partial adherence to WHO rational use standards. Polypharmacy, suboptimal generic prescribing, high antibiotic use, and over-reliance on FDCs remain key concerns. Targeted educational interventions, prescription audits, and antimicrobial stewardship programmes are urgently required to improve prescribing practices.

Keywords: Prescription audit, WHO prescribing indicators, rational drug use, drug utilization, tertiary care, NLEM, antimicrobial stewardship, polypharmacy

Introduction

Rational use of medicines, as defined by the World Health Organization (WHO), requires that patients receive medications appropriate to their clinical needs, in doses that meet their own individual requirements, for an adequate period of time, and at the lowest cost to them and their community. Despite this well-established framework, irrational prescribing practices remain pervasive across both high-income and low-and-middle-income countries (LMICs), with significant public health consequences including avoidable adverse drug reactions, treatment failure, antimicrobial resistance, and substantial economic burden on patients and healthcare systems.

Prescription pattern analysis, a cornerstone of pharmacoepidemiology and drug utilization research (DUR), provides an objective, structured method for evaluating prescribing quality. Using validated WHO/INRUD core prescribing indicators, researchers and policymakers can benchmark prescribing behaviour against internationally accepted standards, identify deviations from clinical guidelines, and design targeted interventions. These indicators — average drugs per prescription, generic prescribing rate, essential medicines adherence, antibiotic and injectable utilisation — have been extensively applied in resource-limited settings where irrational drug use is particularly consequential.

Tertiary care hospitals occupy a unique position in healthcare delivery. As apex referral centres managing complex, multimorbid patients, they are disproportionately exposed to polypharmacy, high-risk drug combinations, and off-formulary prescribing. Simultaneously, they serve as training environments for medical students and residents, making their prescribing culture especially influential in shaping future clinical practice. Studies from across India, including evaluations at AIIMS campuses and other major teaching institutions, have documented significant concerns including excessive FDC use, suboptimal generic prescribing, and antimicrobial over-prescription that contributes to resistance patterns.

Despite growing evidence of the problem, systematic prescription audits remain inconsistently implemented in Indian tertiary care settings. The National Medical Commission (NMC) Registered Medical Practitioner Regulations 2023 and the National List of Essential Medicines (NLEM) 2022 provide updated policy frameworks, yet their impact on day-to-day prescribing practices requires continuous evaluation. Against this backdrop, the present study was designed to comprehensively assess prescription patterns in the OPD of a major tertiary care teaching hospital, using WHO/INRUD indicators, and to evaluate prescription completeness, drug class distribution, and adherence to the NLEM 2022.

2. Objectives

- To evaluate prescribing patterns using WHO/INRUD core prescribing indicators in the outpatient departments of a tertiary care hospital.
- To assess prescription completeness in accordance with standard prescribing norms.
- To identify the most frequently prescribed drug classes and individual drugs.
- To determine adherence to the National List of Essential Medicines (NLEM) 2022.
- To provide evidence-based recommendations for improving prescribing quality and rational drug use.

Materials and Methods

A prospective, cross-sectional observational study was conducted over a six-month period from July 2025 to December 2025 at tertiary care teaching hospital. The hospital provides secondary and tertiary care services across all major specialties including general medicine, surgery, paediatrics, obstetrics and gynaecology, orthopaedics, dermatology, psychiatry, neurology, and ophthalmology. Ethical approval was obtained from the Institutional Ethics Committee prior to data collection. All data were collected from written or printed prescriptions; no patient-identifiable information was recorded.

Sample Size and Sampling

The sample size was calculated in accordance with WHO recommendations, which specify a minimum of 600 prescriptions for evaluation of prescribing indicators; however, to enhance statistical power and allow subgroup analyses by specialty, 1,200 prescriptions were targeted. Prescriptions were collected by systematic random sampling from the outpatient pharmacy dispensing window across all OPD working days during the study period. Every alternate prescription presented at the dispensing counter was selected until the required sample was achieved. Prescriptions for inpatients, emergency cases, and those with illegible or incomplete medication data were excluded.

Data Collection

A pre-designed, pre-validated data collection form was used to record the following parameters for each prescription: patient demographics (age, sex), prescribing department/specialty, number of drugs per prescription, drug names (generic vs. brand), dosage form, route of administration, dose, frequency, duration, presence of diagnosis, prescriber designation, and registration number. Drugs were classified using the Anatomical Therapeutic Chemical (ATC) classification system. Each drug was cross-referenced with the NLEM 2022 and the Essential Medicines List (EML) of Telangana State to determine adherence to essential medicines policies.

WHO/INRUD Prescribing Indicators

The following five WHO/INRUD core prescribing indicators were calculated in accordance with standard methodology:

- Average number of drugs per prescription (ADR): $\text{Total drugs prescribed} \div \text{total prescriptions}$.
- Percentage of drugs prescribed by generic name: $(\text{Drugs with generic name} \div \text{total drugs}) \times 100$.
- Percentage of encounters with an antibiotic prescribed: $(\text{Prescriptions with } \geq 1 \text{ antibiotic} \div \text{total prescriptions}) \times 100$.
- Percentage of encounters with an injectable prescribed: $(\text{Prescriptions with } \geq 1 \text{ injectable} \div \text{total prescriptions}) \times 100$.
- Percentage of drugs prescribed from the NLEM 2022: $(\text{NLEM drugs} \div \text{total drugs}) \times 100$.

Prescription completeness was assessed based on inclusion of patient name, age, sex, date, diagnosis, drug name, dose, route, frequency, duration, prescriber signature, designation, and registration number.

Statistical Analysis

Data were entered into Microsoft Excel 2021 and analysed using SPSS version 26.0 (IBM Corp., Armonk, NY). Descriptive statistics including mean, standard deviation, frequencies, and percentages were used to summarise the data. WHO ideal benchmarks for prescribing indicators were used for comparison. Chi-square tests were applied to assess associations between categorical variables, and a p-value of <0.05 was considered statistically significant.

Results

A total of 1,200 prescriptions were analysed. The study population comprised 672 male patients (56.0%) and 528 female patients (44.0%). The mean age of patients was 41.7 ± 16.8 years (range: 2–84 years). Adults aged 31–60 years represented the largest patient group (48.3%), followed by elderly patients above 60 years (22.1%). General Medicine was the most represented department (24.6%), followed by Orthopaedics (15.3%), Dermatology (12.8%), Obstetrics & Gynaecology (11.4%), Paediatrics (9.7%), and other specialties.

Table 1. Demographic and Departmental Distribution of Study Prescriptions

Parameter	Category	n	%
Sex	Male	672	56.0%
	Female	528	44.0%
Age Group	< 18 years	108	9.0%
	18–30 years	244	20.3%
	31–60 years	580	48.3%
	> 60 years	268	22.4%
Department	General Medicine	295	24.6%
	Orthopaedics	184	15.3%
	Dermatology	154	12.8%
	Obstetrics & Gynaecology	137	11.4%
	Paediatrics	116	9.7%
	Others	314	26.2%

A total of 4,104 drugs were prescribed across 1,200 prescriptions. Table 2 presents the observed values for each WHO/INRUD prescribing indicator alongside the WHO ideal benchmark values.

Table 2. WHO/INRUD Core Prescribing Indicators

WHO Prescribing Indicator	Observed Value	WHO Ideal Benchmark	Deviation
Average drugs per prescription	3.42 (± 1.28)	1.6–1.8	High
% drugs prescribed by generic name	58.7%	100%	Suboptimal
% encounters with antibiotic prescribed	28.6%	20.0–26.8%	Slightly High
% encounters with injectable prescribed	6.8%	< 10%	Within Range
% drugs from NLEM 2022	73.4%	100%	Suboptimal
% prescriptions with FDCs	38.2%	Minimise	Concern

The mean number of drugs per prescription (3.42) was notably higher than the WHO ideal range of 1.6–1.8, indicative of polypharmacy. Generic prescribing at 58.7% fell substantially below the ideal 100%, with 41.3% of drugs still prescribed by brand name. Antibiotic encounters at 28.6% exceeded the globally accepted upper threshold of 26.8%. Injectable drug use at 6.8% remained within acceptable limits. NLEM 2022 adherence at 73.4% was suboptimal, highlighting missed opportunities to promote cost-effective essential medicines.

The most commonly prescribed drug class was proton pump inhibitors (PPIs), predominantly pantoprazole, present in 61.3% of all prescriptions. This was followed by analgesics/anti-inflammatory agents (NSAIDs and paracetamol; 54.8%), antibiotics (28.6%), antihypertensives (24.1%), vitamins and nutritional supplements (21.7%), and antidiabetics (16.4%). Within antibiotics, fluoroquinolones (ciprofloxacin, levofloxacin; 34.2%) and beta-lactams (amoxicillin-clavulanate; 29.8%) were the most frequently prescribed subclasses.

Table 3. Top 10 Most Frequently Prescribed Drug Classes

Rank	Drug Class	No. of Prescriptions	% of Total
1	Proton Pump Inhibitors	736	61.3%
2	Analgesics / NSAIDs	658	54.8%
3	Antibiotics	343	28.6%
4	Antihypertensives	289	24.1%
5	Vitamins & Supplements	261	21.7%
6	Antidiabetics	197	16.4%
7	Antihistamines	168	14.0%
8	Antacids / H2 Blockers	143	11.9%
9	Bronchodilators	112	9.3%
10	Antiepileptics	89	7.4%

Overall prescription completeness was 84.3%. Missing diagnostic information was the most frequent deficiency, identified in 31.4% of prescriptions. Prescriber designation was absent in 18.6%, medical registration number in 22.1%, and patient age in 11.2% of prescriptions. Complete prescriptions with all mandatory elements present accounted for only 67.8% of the total.

Table 4. Prescription Completeness Assessment

Prescription Element	Present (n)	Present (%)	Missing (%)
Patient Name	1184	98.7%	1.3%
Patient Age	1065	88.8%	11.2%
Patient Sex	1102	91.8%	8.2%
Date of Prescription	1176	98.0%	2.0%
Diagnosis / Indication	822	68.5%	31.5%
Drug Name (legible)	1143	95.3%	4.7%
Dose	1098	91.5%	8.5%
Route of Administration	976	81.3%	18.7%
Duration of Treatment	1012	84.3%	15.7%
Prescriber Signature	1152	96.0%	4.0%
Prescriber Designation	976	81.3%	18.7%
Medical Registration No.	934	77.8%	22.2%

Discussion

The present study provides a comprehensive snapshot of prescribing practices at a large tertiary care teaching hospital, and reveals several significant deviations from WHO standards that warrant urgent corrective attention. The mean drugs per prescription of 3.42 — more than double the WHO ideal of 1.6–1.8 — is consistent with the broader pattern of polypharmacy documented in Indian tertiary care settings, where complex multimorbid patients, patient and prescriber expectations, and defensive prescribing tendencies all contribute to escalating drug loads. Studies from AIIMS Bhopal, Osmania General Hospital, and other large Indian institutions have reported similar figures ranging from 2.9 to 4.1 drugs per prescription, underscoring that polypharmacy is a systemic rather than institution-specific problem. Generic prescribing at 58.7% represents a modest improvement over historical baselines in Indian public hospitals, where rates below 30% were common a decade ago. This improvement likely reflects the influence of NMC regulations mandating generic prescribing and government-led Jan Aushadhi initiatives. However, 41.3% of drugs still being prescribed by brand name represents a substantial gap with significant implications for affordability, particularly for the large proportion of patients who purchase medications from private pharmacies rather than hospital dispensaries. Brand-name prescribing has been consistently shown to drive higher out-of-pocket expenditure, with studies estimating 30–60% premium costs for equivalent branded drugs over generics. Antibiotic prescribing at 28.6% exceeded the WHO upper threshold of 26.8% and is a matter of serious public health concern. Antibiotic resistance is already classified as a global health emergency by the WHO, and India bears a disproportionate share of this burden, being both the world's largest antibiotic consumer and home to a significant reservoir of multi-drug resistant organisms. The predominance of fluoroquinolones and broad-spectrum beta-lactam combinations in the current study reflects a concerning preference for empirical broad-spectrum therapy that may accelerate resistance. Implementation of robust Antimicrobial Stewardship Programmes (ASPs), which have demonstrated 20–35% reductions in antibiotic prescribing in comparable settings, should be prioritised.

The high PPI prescribing rate (61.3%) merits particular attention. While acid-suppressive therapy is clinically appropriate in many contexts — particularly as gastroprotection with NSAID therapy — the almost reflexive co-prescription of PPIs across virtually all clinical scenarios represents what the literature describes as 'prescribing cascade' behaviour. Unindicated PPI use is associated with increased risk of *Clostridium difficile* infection, community-acquired pneumonia,

hypomagnesaemia, vitamin B12 deficiency, and osteoporosis-related fractures. Educational interventions specifically targeting PPI prescribing have been effective in reducing inappropriate use in multiple studies.

FDC prevalence of 38.2% warrants scrutiny given ongoing regulatory concerns in India about the proliferation of irrational fixed-dose combinations. While pharmacologically rational FDCs such as antihypertensive combinations can improve adherence and simplify regimens, many commercially available FDCs in India lack adequate evidence of therapeutic advantage and are sold at premium prices. The Drug Technical Advisory Board (DTAB) and the Central Drugs Standard Control Organisation (CDSCO) have banned hundreds of such FDCs in recent years, yet their prescription continues, reflecting the lag between regulatory action and clinical practice change.

NLEM 2022 adherence at 73.4%, while higher than several previously published Indian studies, indicates that over one-quarter of drugs prescribed were outside the essential medicines framework — including expensive brand-name products and FDCs with limited essential medicine equivalents. Given that NLEM adherence directly correlates with medication affordability and availability at public hospital dispensaries, improving this indicator is directly linked to health equity outcomes for the predominantly lower-income population served by tertiary public hospitals.

Prescription completeness of 84.3%, with diagnosis recorded in only 68.5% of prescriptions, represents a significant patient safety and medicolegal concern. Incomplete prescriptions impair pharmacist verification, clinical audit, and adverse drug reaction monitoring. The absence of diagnosis documentation in nearly one-third of prescriptions also undermines the possibility of meaningful prescription audit. NMC regulations explicitly mandate diagnosis documentation, and institution-level enforcement of this standard through electronic prescribing systems or prescription proforma redesign could be transformative.

Conclusion

This study demonstrates that prescribing practices at a major tertiary care teaching hospital show partial alignment with WHO rational

use standards, but significant gaps remain across multiple prescribing indicators. Polypharmacy, suboptimal generic prescribing, high antibiotic utilisation, over-reliance on FDCs, pervasive unnecessary PPI prescribing, and suboptimal prescription completeness collectively represent a substantial quality improvement challenge. These findings mirror patterns reported from comparable institutions across India and LMICs, suggesting systemic rather than isolated prescribing problems. A multi-pronged intervention strategy encompassing antimicrobial stewardship, generic prescribing mandates, prescription audit systems, CME, and electronic decision-support tools is essential. Sustained, longitudinal prescription auditing should become a core hospital quality indicator, embedded within accreditation frameworks such as NABH.

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