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Original Research Article

Assessment of Rational Drug Use in a Tertiary Care Hospital Using WHO Core Prescribing Indicators

Devesh Gupta[1], Sandhya Rani Gautam[2], Shilpa Bhardwaj[3]

[1]Associate Professor, Department of Neuropsychopharmacology, Institute of Human Behaviour and Allied Science, Dilshad Garden, New Delhi, India

[2]Associate Professor, Department of Pharmacology, University College of Medical Sciences & GTB Hospital, Delhi, India

[3]Associate Professor, Department of Neurochemistry, Institute of Human Behaviour and Allied Science, Dilshad Garden, New Delhi, India

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Corresponding Author: Dr. Shilpa Bhardwaj

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Abstract

Background: Rational prescribing is essential for optimizing therapeutic outcomes and minimizing healthcare costs. However, inappropriate drug use remains a significant concern globally. The World Health Organization prescribing indicators provide a standardized method to evaluate drug utilization patterns.

Methods: A hospital-based cross-sectional study was conducted over six months in the outpatient departments of a tertiary care teaching hospital. A total of 634 prescriptions were analyzedusing WHO prescribing indicators. Data regarding number of drugs, generic prescribing, antibiotic and injection use, and adherence to the Essential Medicines List (EML) were collected and analyzed using descriptive statistics and appropriate inferential tests.

Results: A total of 1,742 drugs were prescribed, with an average of 2.75 ± 1.21 drugs per encounter. Polypharmacy was observed in 11.7% of prescriptions. Generic prescribing was 41.6%, while 68.4% of drugs were from the EML. Antibiotics and injections were prescribed in 34.9% and 13.7% of encounters, respectively. Significant variations were observed across departments in antibiotic use, injection prescribing, and adherence to generic and EML prescribing ($p < 0.05$).

Conclusion: Prescribing practices showed moderate adherence to WHO guidelines, with notable deviations in antibiotic use and generic prescribing. Strengthening prescription audits and promoting rational drug use strategies are essential to improve prescribing quality.

Keywords: Rational Drug Use; WHO Prescribing Indicators; Polypharmacy; Antibiotic Use; Essential Medicines.

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Introduction

Rational use of medicines is a cornerstone of effective healthcare delivery, yet inappropriate prescribing remains a persistent global challenge [1]. The World Health Organization defines rational drug use as patients receiving medications appropriate to their clinical needs, in doses that meet individual requirements, for an adequate period, and at the lowest cost to them and the community [2]. However, it is estimated that more than 50% of medicines worldwide are prescribed, dispensed, or sold inappropriately, while a similar proportion of patients fail to take them correctly [3]. Such irrational practices contribute to increased morbidity, mortality, adverse drug reactions, antimicrobial resistance, and unnecessary economic burden on healthcare systems [3].

To systematically evaluate prescribing practices, the WHO, in collaboration with the International Network for Rational Use of Drugs, developed a set of standardized core drug use indicators [4]. Among these, the WHO prescribing indicators—average number of drugs per encounter, percentage of drugs prescribed by generic name, percentage of encounters with an antibiotic prescribed, percentage of encounters with an injection prescribed, and percentage of drugs prescribed from the essential medicines list—are widely used tools for assessing the quality and rationality of prescriptions [4]. These indicators provide objective, reproducible, and comparable measures across different healthcare settings [4].

Polypharmacy, often reflected by an increased average number of drugs per prescription, is particularly concerning in tertiary care hospitals where patients frequently present with multiple comorbidities [5]. Developing countries report an average of 2.5–4.5 drugs per prescription, exceeding the WHO recommended optimal value of 1.6–1.8 [6]. Excessive use of antibiotics (often >30% of encounters) and injections (>20%) has also been documented, deviating from WHO standards of ≤30% and ≤10% respectively, thereby raising concerns about antimicrobial resistance and injection-related complications [7].

Generic prescribing and adherence to the essential medicines list (EML) are key strategies to promote cost-effective therapy and improve accessibility. Despite recommendations that 100% of drugs should be prescribed by generic name and from the EML, it is shown suboptimal compliance, particularly in tertiary care settings where brand prescribing is prevalent [8,9]. This not only increases treatment costs but also impacts patient adherence and overall healthcare equity [9].Tertiary care teaching hospitals play a pivotal role in shaping prescribing behavior, as they serve as training grounds for future physicians. Evaluating prescription patterns in such institutions is essential not only for identifying deviations from standard guidelines but also for implementing targeted interventions such as prescription audits, educational programs, and antimicrobial stewardship initiatives [10]. In this context, the present study aimed to evaluate drug prescription practices using WHO prescribing indicators in a tertiary care teaching hospital. The findings are expected to provide insight into current prescribing trends, identify areas of irrational drug use, and contribute to the promotion of evidence-based and rational pharmacotherapy.

Materials and Methods

Study design and setting: This was a hospital-based, observational cross-sectional study conducted in the department of Pharmacology in a tertiary care teaching hospital over a period of 24 months, from January 2023 to December 2024. The institution provides comprehensive healthcare services across multiple specialties and serves as a referral center for a large and diverse patient population. Data were collected on preselected weekdays during routine OPD hours to capture representative prescribing practices.

Study population and sampling: The study population comprised prescriptions issued to patients attending major clinical OPDs, including General Medicine, Surgery, Pediatrics, and Obstetrics and Gynecology. Prescriptions were included irrespective of patient age and gender, provided they were complete and legible. Prescriptions containing only procedural advice, immunization, or incomplete information were excluded. A systematic random sampling technique was employed, wherein every 10th prescription was selected on designated data collection days to minimize selection bias. As per recommendations of the World Health Organization, a minimum of 600 encounters is considered adequate for drug utilization studies, so a total of 634 prescriptions were analyzed.

Data collection procedure: Data were collected prospectively at the point of care, either immediately after patient consultation or at the pharmacy during dispensing. A predesigned and pretested structured data collection form was used, based on prescribing indicators developed by the World Health Organization in collaboration with the International Network for Rational Use of Drugs. The form captured patient demographics (age and gender) and prescription details including number of drugs, drug names (generic or brand), dosage form, route of administration, frequency, and duration of therapy. A pilot study was conducted on a small subset of prescriptions to validate the data collection tool, and necessary modifications were made prior to the main study. Data collection was performed by trained investigators, and periodic cross-checking was undertaken to ensure accuracy and consistency.

Operational definitions: For the purpose of this study, a “drug” was defined as a single therapeutic agent; fixed-dose combinations (FDCs) were counted as one drug irrespective of the number of active ingredients. Drugs prescribed by their International Nonproprietary Name (INN) were considered as generic prescriptions. An “antibiotic” was defined as any antimicrobial agent prescribed for the treatment of bacterial infections, classified according to standard pharmacological categories. An “injection” included any parenteral formulation administered via intravenous, intramuscular, or subcutaneous routes. Essential medicines were identified based on their inclusion in the National List of Essential Medicines (NLEM; 2022).

Study variables and WHO prescribing indicators: The primary outcome measures were the core prescribing indicators defined by the World Health Organization. These included the average number of drugs per encounter, calculated as the total number of drugs prescribed divided by the number of prescriptions analyzed; the percentage of drugs prescribed by generic name; the percentage of encounters with an antibiotic prescribed; the percentage of encounters with an injection prescribed; and the percentage of drugs prescribed from the essential medicines list.

All indicators were calculated using standard WHO-recommended formulas to ensure comparability with similar studies.

Data Analysis: The collected data were entered into Microsoft Excel and analyzed using Statistical Package for the Social Sciences (SPSS) version 20.0. Descriptive statistics were applied, with continuous variables expressed as mean ± standard deviation and categorical variables presented as frequencies and percentages.

The calculated prescribing indicators were compared with WHO reference values to evaluate the rationality of prescribing practices. No inferential statistical tests were applied, as the study was primarily descriptive in nature.

Ethical Considerations: The study was conducted after obtaining approval from the Institutional Ethics Committee. As the study involved analysis of prescriptions without direct patient interaction or intervention, a waiver of informed consent was granted. Confidentiality and anonymity of patient information were strictly maintained, and no personally identifiable data were recorded at any stage of the study.

Results

The study included 634 prescriptions, with the majority of patients belonging to the 18–40 years age group (42.3%), followed by 41–60 years (28.1%). Pediatric patients (<18 years) constituted 15.1%, while elderly patients (>60 years) accounted for 14.5%.

There was a slight male predominance (55.5%) compared to females (44.5%). Department-wise distribution showed that most prescriptions were from General Medicine (39.1%), followed by Pediatrics (21.8%), Obstetrics &Gynecology (19.9%), and Surgery (19.2%), indicating a balanced representation across major clinical specialties (Table 1).

Table 1: Baseline demographic and clinical characteristics of study population (n = 634)

Variable	Frequency	%
Age group (years)		
<18	96	15.1
18–40	268	42.3
41–60	178	28.1
>60	92	14.5
Gender		
Male	352	55.5
Female	282	44.5
Department		
General Medicine	248	39.1
Surgery	122	19.2
Pediatrics	138	21.8
Obstetrics &Gynecology	126	19.9

OBG = Obstetrics &Gynecology.

A total of 1,742 drugs were prescribed across 634 encounters. The majority of prescriptions (88.3%) fell under non-polypharmacy (<5 drugs), while polypharmacy (≥5 drugs) was observed in 11.7% of cases. Most prescriptions contained two (29.3%) or three drugs (25.9%), followed by four drugs (17.0%) and single-drug prescriptions (16.1%). Among drug classes, antibiotics were the most frequently prescribed (17.9%), followed by NSAIDs (16.4%) and proton pump inhibitors (14.2%). Other commonly prescribed classes included vitamins and supplements (12.7%), antihypertensives (11.3%), and antidiabetic agents (10.0%), reflecting a mix of acute and chronic disease management (Table 2).

Table 2: Distribution of number of drugs per prescription and commonly prescribed drug classes (n = 634 prescriptions; 1,742 drugs)

Variables	Frequency	%
Number of drugs		
Non-polypharmacy (<5 drugs)	560	88.3
1	102	16.1
2	186	29.3
3	164	25.9
4	108	17
Polypharmacy (≥5 drugs)	74	11.7
Drug class		

Antibiotics	312	17.9
NSAIDs	286	16.4
Proton Pump Inhibitors	248	14.2
Antihypertensives	196	11.3
Antidiabetics	174	10
Vitamins & Supplements	221	12.7
Others	305	17.5

NSAIDs = Non-steroidal anti-inflammatory drugs

The average number of drugs per encounter was 2.75 ± 1.21, exceeding the WHO recommended range (1.6–1.8). Generic prescribing was observed in 41.6% of drugs, which is substantially lower than the ideal value of 100%. Antibiotics were prescribed in 34.9% of encounters, slightly above the WHO threshold of ≤30%, while injections were used in 13.7% of encounters, also exceeding the recommended ≤10%. Additionally, 68.4% of drugs were prescribed from the essential medicines list, indicating moderate adherence to national prescribing guidelines (Table 3).

Table 3: WHO prescribing indicators (n = 634 encounters)

Indicator	Observed Value	WHO Standard
Total number of drugs prescribed	1,742	—
Average number of drugs per encounter	2.75 ± 1.21	1.6–1.8
Drugs prescribed by generic name	725 (41.6%)	100%
Encounters with an antibiotic	222 (34.9%)	≤30%
Encounters with an injection	87 (13.7%)	≤10%
Drugs prescribed from EML	1,191 (68.4%)	100%

WHO = World Health Organization; EML = Essential Medicines List.

There was a statistically significant variation in antibiotic and injection prescribing across departments ($p < 0.001$). Antibiotic use was highest in Surgery (47.5%), followed by General Medicine (41.1%) and Pediatrics (31.9%), while it was lowest in Obstetrics & Gynecology (14.3%). Similarly, injection use was most frequent in Surgery (26.2%), followed by General Medicine (15.3%), and was comparatively lower in Pediatrics (7.2%) and Obstetrics & Gynecology (5.6%). These findings suggest specialty-specific prescribing patterns, particularly higher antibiotic and injection utilization in surgical settings (Table 4).

Table 4: Department-wise distribution of antibiotic and injection prescribing (n = 634)

Department	Antibiotic prescribed	Injection prescribed	p value
	Frequency (%)		
General Medicine (n=248)	102 (41.1)	38 (15.3)	<0.001
Surgery (n=122)	58 (47.5)	32 (26.2)	
Pediatrics (n=138)	44 (31.9)	10 (7.2)	
Obstetrics &Gynecology (n=126)	18 (14.3)	7 (5.6)	
Total	222 (34.9)	87 (13.7)	

Generic prescribing and EML adherence varied significantly across departments ($p = 0.012$). Pediatrics demonstrated the highest rate of generic prescribing (48.2%) and EML adherence (74.6%), followed by General Medicine (44.8% and 71.2%, respectively). In contrast, lower rates were observed in Surgery (36.5% and 62.3%) and Obstetrics &Gynecology (34.9% and 64.1%). Overall, only 41.6% of drugs were prescribed by generic name, and 68.4% were from the EML, indicating scope for improvement in rational prescribing practices (Table 5).

Table 5: Department-wise generic prescribing and EML adherence (n = 1,742 drugs)

Department	Generic prescribing	EML prescribing	p value
	Frequency (%)		
General Medicine	312 (44.8%)	496 (71.2%)	0.012
Surgery	149 (36.5%)	254 (62.3%)	
Pediatrics	198 (48.2%)	306 (74.6%)	
Obstetrics &Gynecology	66 (34.9%)	121 (64.1%)	
Overall	725 (41.6%)	1,191 (68.4%)	

EML = Essential Medicines List

The average number of drugs per prescription increased significantly with age (p = 0.004). Pediatric patients (<18 years) had the lowest mean drug count (2.38 ± 1.02), followed by the 18–40 years (2.61 ± 1.15) and 41–60 years (2.89 ± 1.22) groups. The highest number of drugs per prescription was observed in patients aged >60 years (3.21 ± 1.34), indicating a higher burden of polypharmacy among the elderly population (Table 6).

Table 6: Average number of drugs per prescription across age groups

Age group (years)	Mean ± SD	p value
<18	2.38 ± 1.02	0.004
18–40	2.61 ± 1.15	
41–60	2.89 ± 1.22	
>60	3.21 ± 1.34	

Discussion

This study evaluated prescribing practices in a tertiary care teaching hospital using standard indicators of the World Health Organization, providing a comprehensive picture of drug utilization patterns. The findings reveal a mixed scenario, with evidence of both rational prescribing trends and areas requiring improvement, particularly in relation to polypharmacy, antibiotic use, injection practices, and generic prescribing.

The average number of drugs per encounter in the present study (2.75 ± 1.21) was higher than the WHO recommended range (1.6–1.8), indicating a tendency toward polypharmacy. Although only 11.7% of prescriptions met the formal definition of polypharmacy (≥5 drugs), a substantial proportion contained two to four medications, reflecting moderate polypharmacy. Similar findings have been reported in Indian studies by Tripathy et al., Joshi et al., Meena et al., where the average number of drugs per prescription ranges from 2.5 to 3.8 [11,12,13]. This trend may be attributed to the high burden of comorbid conditions, particularly in tertiary care settings, as well as a tendency toward symptomatic prescribing (e.g., addition of proton pump inhibitors and vitamin supplements) [13]. The significant increase in the number of drugs prescribed with advancing age (p = 0.004) further supports the role of multimorbidity in driving polypharmacy, a pattern consistently observed in both Indian and global studies by Shareef et al., and Villén et al., [14,15]. While some degree of polypharmacy may be clinically justified, excessive prescribing increases the risk of adverse drug reactions, drug–drug interactions, and reduced patient adherence [15].

Antibiotic prescribing in this study (34.9%) exceeded the WHO recommended threshold of ≤30%, although it remained comparable to findings from other Indian tertiary care hospitals in studies by Bhattacharjee et al., and Christina et al., where antibiotic use ranges from 30% to 60% of encounters [16,17]. Department-wise analysis revealed significantly higher antibiotic utilization in surgical specialties (47.5%), likely reflecting prophylactic and therapeutic use in perioperative settings. However, such elevated use raises concerns regarding inappropriate or prolonged prophylaxis, which is a well-recognized contributor to antimicrobial resistance [18]. Globally, irrational antibiotic use has been identified as a major driver of resistance, particularly in low- and middle-income countries [19]. These findings underscore the need for strengthened antimicrobial stewardship programs, adherence to standard treatment guidelines, and regular prescription audits [19].

The proportion of encounters with injections (13.7%) was also higher than the WHO recommended limit of ≤10%. This pattern was particularly evident in surgical departments (26.2%), where injectable medications are commonly used for perioperative management and acute care. While the use of injections may be clinically justified in certain settings, their overuse is associated with increased healthcare costs, risk of transmission of blood-borne infections, and reduced patient comfort [20]. Comparable studies from India by Chenchula et al., and Pathak et al., have similarly reported injection use ranging from 10% to 25%, suggesting that this remains a persistent area of concern [21,22].

Generic prescribing in the present study was observed in only 41.6% of drugs, which is considerably lower than the WHO ideal of 100%. This finding aligns with Indian studies by Raghute et al., and Halder et al., reporting low rates of generic prescribing, often between 30% and 60% [23,24]. Factors contributing to this trend may include physician preference for branded medications, perceived differences in quality, pharmaceutical marketing influences, and lack of awareness or confidence in generic alternatives [25]. Notably, pediatric and general medicine departments demonstrated relatively higher rates of generic prescribing, possibly reflecting greater adherence to standard treatment protocols [25]. The low rate of generic prescribing has important implications for healthcare affordability, particularly in resource-limited settings like India, where out-of-pocket expenditure remains high [25].

Similarly, the proportion of drugs prescribed from the Essential Medicines List (EML) was 68.4%,

indicating moderate adherence but falling short of the ideal target. Studies from India by Agrawal et al., and Yuvaraj et al., have reported EML adherence rates ranging from 60% to 85%, placing the present findings within a comparable range [26,27]. Higher adherence observed in pediatrics and general medicine suggests better alignment with national guidelines in these departments, whereas lower adherence in surgical and obstetric specialties may reflect the use of specialized or branded formulations not included in the EML [27].

Improving adherence to the EML is crucial for ensuring cost-effective, evidence-based therapy and optimizing resource utilization [27]. The distribution of drug classes further highlights prevailing prescribing trends. Antibiotics, NSAIDs, and proton pump inhibitors were among the most frequently prescribed medications, consistent with other Indian studies by Khanna et al., and Verma et al., [28,29].

The frequent use of proton pump inhibitors, often as prophylaxis, may indicate a tendency toward defensive prescribing, which warrants critical evaluation. The substantial use of vitamins and supplements (12.7%) also raises questions regarding their clinical necessity, as irrational supplementation is commonly reported in outpatient settings [30].

Limitations

This study has certain limitations. Being a single-center, cross-sectional prescription audit, the findings may not be generalizable to other healthcare settings. The study assessed prescribing patterns without evaluating clinical appropriateness or patient outcomes. Seasonal variations in disease patterns were not considered. Additionally, factors influencing prescribing behavior, such as physician experience and pharmaceutical promotion, were not explored.

Conclusion

The present study highlights important insights into prescribing practices in a tertiary care teaching hospital using World Health Organization prescribing indicators. While most prescriptions reflected rational trends with low prevalence of overt polypharmacy, deviations from WHO standards were evident in terms of higher average drugs per encounter, antibiotic and injection use, and suboptimal generic prescribing and EML adherence.

These findings underscore the need for targeted interventions, including antimicrobial stewardship, promotion of generic prescribing, and adherence to essential medicines lists. Regular prescription audits, clinician education, and institutional policy reinforcement are crucial to ensure rational, cost-effective, and evidence-based pharmacotherapy.

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