



Evaluation of Drug Utilization Patterns and Potentially Inappropriate Prescribing among Patients Attending a Tertiary Care Centre: A Retrospective Observational Study

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ABSTRACT

Background: Rational use of medicines is an essential component of safe and effective healthcare. Inappropriate prescribing, polypharmacy, excessive use of selected therapeutic classes and inadequate use of generic medicines may increase the risk of adverse drug reactions, drug interactions, medication errors and unnecessary healthcare expenditure. Drug utilization studies provide useful information regarding prevailing prescribing practices and help identify opportunities for improving the quality of pharmacotherapy. The present study was undertaken to evaluate drug utilization patterns and the prevalence of potentially inappropriate prescribing among patients attending a tertiary care centre.

Methods: A retrospective observational study was conducted using 400 patient records from selected clinical departments of a tertiary care centre over a 12-month period from July 2023 to June 2024. Demographic characteristics, clinical department, primary diagnosis, number of comorbidities, number of prescribed medicines, generic prescribing, antibiotic use, proton pump inhibitor (PPI) use, non-steroidal anti-inflammatory drug (NSAID) use, fixed-dose combinations (FDCs), and potentially inappropriate prescribing (PIP) were assessed. Polypharmacy was defined as prescription of five or more medicines during the assessed clinical encounter. Descriptive statistics were used to summarize prescribing patterns.

Results: Among the 400 patient records analysed, 208 (52.0%) were from males and 192 (48.0%) from females. The mean age was 51.95±17.12 years (range, 18–90 years). General Medicine accounted for the largest proportion of records (33.5%), followed by General Surgery (18.0%) and Obstetrics and Gynaecology (14.8%). The median number of medicines prescribed per patient was four, while 148 (37.0%) received five or more medicines. Antibiotics were prescribed in 192 (48.0%) records, PPIs in 235 (58.8%), NSAIDs in 118 (29.5%), and FDCs in 115 (28.8%) records. The mean recorded generic-prescribing percentage was 56.21±17.47%. PIP was identified in 48 (12.0%) records (95% CI, 9.2%–15.6%). Patients with PIP received a greater mean number of medicines than those without PIP (5.04±1.56 vs. 3.78±1.42). Polypharmacy was significantly associated with PIP ($\chi^2=25.16$, $p<0.001$, Pearson chi-square with continuity correction). Among patients aged ≥ 65 years, 48/91 (52.7%) had PIP, compared with 0/309 among those aged <65 years ($\chi^2=180.25$, $p<0.001$, Pearson chi-square with continuity correction).

Conclusion: The study demonstrated substantial polypharmacy and frequent prescribing of selected therapeutic classes in routine clinical practice. PIP was identified in 12.0% of records and was concentrated among older patients and those receiving multiple medicines. These findings support systematic medication review, particularly for older adults and patients exposed to complex medication regimens. Interpretation of PIP, however, depends on the validated assessment criterion used and should be reported explicitly in the final submission.

Keywords: Drug utilization; rational prescribing; potentially inappropriate prescribing; polypharmacy; prescribing pattern; tertiary care; pharmacology; retrospective study.

INTRODUCTION

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Medicines constitute one of the most important components of modern healthcare, and appropriate pharmacotherapy contributes substantially to the prevention and treatment of disease. However, the availability of an increasing number of therapeutic agents and the growing complexity of clinical care have also increased the possibility of inappropriate or unnecessary medicine use. Irrational prescribing may result in treatment failure, adverse drug reactions, drug interactions, avoidable expenditure and increased burden on healthcare systems.

Drug utilization research is an important component of clinical pharmacology and pharmacoepidemiology. It provides a systematic approach to examining how medicines are prescribed, dispensed and used in a defined population. The World Health Organization (WHO) recommends the Anatomical Therapeutic Chemical/Defined Daily Dose (ATC/DDD) methodology as an internationally standardized approach for quantifying medicine utilization. However, prescription-based studies may also evaluate practical indicators such as the number of medicines prescribed, generic prescribing, antibiotic use, fixed-dose combinations and use of specific therapeutic classes.

Polypharmacy is particularly important in patients with multiple diseases. Although there is no universally applicable definition of polypharmacy, the use of five or more medicines is commonly adopted as an operational threshold in clinical research. Increasing numbers of prescribed medicines may increase treatment complexity and the potential for drug-drug interactions, medication errors, therapeutic duplication and adverse drug events.

Potentially inappropriate prescribing (PIP) represents an important aspect of medication safety. A medicine may be considered potentially inappropriate when its expected risks outweigh its benefits in a particular patient, when safer alternatives are available, or when it is used in an inappropriate clinical context. PIP is especially relevant among older adults, who frequently have multiple comorbidities and altered pharmacokinetic and pharmacodynamic responses to medicines.

The American Geriatrics Society Beers Criteria provide an established framework for identifying potentially inappropriate medications in adults aged 65 years and older. The 2023 update incorporates revisions to medications and clinical situations that warrant particular caution. Similarly, the STOPP/START criteria provide a structured approach to identifying potentially inappropriate medicines and prescribing omissions in older people. The present study was therefore undertaken to evaluate drug utilization patterns and the prevalence of potentially inappropriate prescribing among patients attending a tertiary care centre.

AIM AND OBJECTIVES

Aim

To evaluate drug utilization patterns and potentially inappropriate prescribing among patients attending a tertiary care centre.

Primary Objective

To determine the prevalence of potentially inappropriate prescribing among patients whose medical records were included in the study.

Secondary Objectives

1. To describe the demographic and clinical characteristics of the study population.
2. To determine the average and median number of medicines prescribed per patient.
3. To estimate the prevalence of polypharmacy.
4. To assess the proportion of prescriptions containing antibiotics.
5. To determine the frequency of PPI and NSAID prescribing.
6. To determine the frequency of fixed-dose combination prescribing.
7. To assess the extent of prescribing by generic name.
8. To examine the association between potentially inappropriate prescribing and selected patient and prescribing characteristics.

MATERIALS AND METHODS

Study Design

A retrospective observational study was conducted to evaluate drug utilization patterns and potentially inappropriate prescribing. The manuscript was structured in accordance with the principles of the STROBE recommendations for observational studies.

Study Setting

The study was conducted in a tertiary care healthcare centre, involving patient records from selected clinical departments. The study was undertaken through the Department of Pharmacology and included records from General Medicine, General Surgery, Obstetrics and Gynaecology, Orthopaedics, ENT, and Dermatology.

Study Period

The study covered 12 months, from July 2023 to June 2024.

Sample Size

A total of 400 patient records were included in the analysis.

Study Population

The study population consisted of patients attending the participating clinical departments whose medical records contained adequate information regarding diagnosis and prescribed medicines during the study period.

Inclusion Criteria

1. Records of patients attending the participating clinical departments during the study period.
2. Records containing information regarding age and sex.
3. Records with a documented primary diagnosis.
4. Records containing sufficient prescribing information to determine the number and type of medicines prescribed.

Exclusion Criteria

1. Records lacking essential demographic information.
2. Records without sufficient prescribing information for assessment.
3. Duplicate records.
4. Records incomplete to an extent that prevented assessment of the primary study variables.

Data Collection

Data were retrospectively extracted from patient records using a structured data collection format. The following variables were evaluated:

- Record identification number
- Age
- Sex
- Clinical department
- Primary diagnosis
- Number of comorbidities
- Number of prescribed medicines
- Polypharmacy
- Generic prescribing
- Antibiotic prescription
- PPI prescription
- NSAID prescription
- Fixed-dose combination prescription
- Potentially inappropriate prescribing

The study dataset contained 400 records with complete entries for the variables included in the analysis.

Operational Definitions

Polypharmacy

Polypharmacy was operationally defined as prescription of five or more medicines to a patient during the assessed clinical encounter.

Generic prescribing

Generic prescribing was expressed as the percentage of prescribed medicines documented by their generic names. The manuscript reports the mean of the patient-level generic-prescribing percentages recorded in the dataset.

Antibiotic prescribing

A prescription was considered positive for antibiotic use when at least one systemic or clinically documented antibacterial medicine was included in the prescription record.

PPI prescribing

PPI use was recorded when a proton pump inhibitor was present in the prescription.

NSAID prescribing

NSAID use was recorded when at least one non-steroidal anti-inflammatory drug was prescribed.

Fixed-dose combination

An FDC was considered present when two or more active pharmaceutical ingredients were combined in a single dosage form.

Statistical Analysis

Data were entered into a spreadsheet and analysed using appropriate statistical methods. Continuous variables were summarized using mean and standard deviation, median and range, as appropriate. Categorical variables were expressed as frequencies and percentages. Associations between categorical variables were evaluated using the Pearson chi-square test; continuity correction (Yates correction) was applied to 2×2 contingency tables. A two-sided p value <0.05 was considered statistically significant. The principal outcome was the proportion of records with potentially inappropriate prescribing.

Because the analytical dataset did not contain individual drug-level ATC codes, quantities, doses or treatment duration, WHO ATC/DDD-based consumption measures such as DDD/1000 inhabitants/day or DDD/100 bed-days were not calculated.

RESULTS

Demographic Characteristics

A total of 400 patient records were analysed. The mean age of the study population was 51.95 ± 17.12 years, with an age range of 18–90 years. Males constituted 52.0% of the study population and females 48.0%. The mean number of comorbidities was 1.00 ± 0.95 , and the median number of medicines prescribed was four.

Table 1. Demographic characteristics of the study population

Characteristic	Finding
Total records	400
Mean age $\pm$ SD	51.95 ± 17.12 years
Age range	18–90 years
Male	208 (52.0%)
Female	192 (48.0%)
Mean number of comorbidities	1.00 ± 0.95
Median number of medicines	4

Distribution According to Clinical Department

General Medicine contributed the largest proportion of records, accounting for 134 (33.5%) patients. General Surgery contributed 72 (18.0%), followed by Obstetrics and Gynaecology with 59 (14.8%), Orthopaedics with 56 (14.0%), ENT with 40 (10.0%) and Dermatology with 39 (9.8%).

Table 2. Distribution of patient records according to clinical department

Clinical department	n	%
General Medicine	134	33.5
General Surgery	72	18.0
Obstetrics & Gynaecology	59	14.8
Orthopaedics	56	14.0
ENT	40	10.0
Dermatology	39	9.8
Total	400	100

Pattern of Medicine Utilization

The number of medicines prescribed per patient ranged from one to nine. The median number of medicines was four. A total of 148 patients (37.0%) received five or more medicines and therefore fulfilled the study definition of polypharmacy.

Table 3. Prescribing indicators

Indicator	Finding
Polypharmacy (≥ 5 medicines)	148 (37.0%)
Antibiotic prescribed	192 (48.0%)
PPI prescribed	235 (58.8%)
NSAID prescribed	118 (29.5%)
Fixed-dose combination prescribed	115 (28.8%)
Mean recorded generic-prescribing percentage	$56.21 \pm 17.47\%$
Median number of medicines	4

Potentially Inappropriate Prescribing

Potentially inappropriate prescribing was identified in 48 of 400 records (12.0%; 95% CI, 9.2%–15.6%). The remaining 352 records (88.0%) were not classified as having PIP according to the study dataset.

The mean age of patients with PIP was 76.88 ± 8.25 years compared with 48.55 ± 15.09 years among those without PIP. The mean number of medicines was 5.04 ± 1.56 in the PIP group and 3.78 ± 1.42 in the non-PIP group. Mean comorbidity counts were 1.21 ± 1.09 and 0.97 ± 0.93 , respectively.

Table 4. Comparison of patients with and without potentially inappropriate prescribing

Variable	No PIP (n=352)	PIP (n=48)
Mean age, years	48.55 ± 15.09	76.88 ± 8.25
Median age, years	49	76.5
Mean number of medicines	3.78 ± 1.42	5.04 ± 1.56
Median number of medicines	4	5
Mean comorbidity count	0.97 ± 0.93	1.21 ± 1.09

Association between Polypharmacy and PIP

Among patients with polypharmacy, 34 of 148 (23.0%) had PIP, compared with 14 of 252 (5.6%) among those without polypharmacy. This association was statistically significant (Pearson $\chi^2=25.16$, $p<0.001$, with continuity correction).

Table 5. Association between polypharmacy and potentially inappropriate prescribing

Polypharmacy	No PIP	PIP	Total
No	238	14	252
Yes	114	34	148
Total	352	48	400

Pearson $\chi^2=25.16$; $p<0.001$ (continuity-corrected 2×2 chi-square).

Potentially Inappropriate Prescribing According to Age

Among patients aged ≥ 65 years, 48 of 91 (52.7%) were classified as having PIP, whereas none of the 309 patients aged <65 years were classified as having PIP. This association was statistically significant (Pearson $\chi^2=180.25$, $p<0.001$, with continuity correction). Because all PIP observations occurred in the ≥ 65 -year group, this result should be interpreted in the context of the underlying PIP classification method.

Table 6. Age and potentially inappropriate prescribing

Age group	No PIP	PIP	Total
<65 years	309	0	309
≥ 65 years	43	48	91
Total	352	48	400

Pearson $\chi^2=180.25$; $p<0.001$ (continuity-corrected 2×2 chi-square).

PIP According to Clinical Department

The highest descriptive proportion of PIP was observed in Dermatology (17.9%), followed by Obstetrics and Gynaecology (16.9%) and General Surgery (13.9%). These differences are descriptive and should not be interpreted as evidence of department-specific prescribing quality without adjustment for patient age, disease severity, case mix and prescribing complexity.

Table 7. Department-wise distribution of PIP

Department	Total records	PIP n (%)
Dermatology	39	7 (17.9)
Obstetrics & Gynaecology	59	10 (16.9)
General Surgery	72	10 (13.9)
General Medicine	134	14 (10.4)
Orthopaedics	56	5 (8.9)
ENT	40	2 (5.0)

DISCUSSION

The present retrospective observational study evaluated medicine utilization patterns and potentially inappropriate prescribing among 400 patient records from a tertiary care centre over a 12-month period. The findings demonstrate a considerable frequency of polypharmacy and frequent prescribing of selected therapeutic classes, together with a measurable prevalence of PIP.

The mean age of the study population was approximately 52 years, and males and females were relatively evenly represented. General Medicine accounted for approximately one-third of the records, while the remaining records were distributed across General Surgery, Obstetrics and Gynaecology, Orthopaedics, ENT and Dermatology.

One important finding was that 37.0% of records involved five or more medicines. Polypharmacy is clinically relevant because increasing medication burden can increase treatment complexity and the potential for drug-drug interactions, adverse effects and medication-related problems. In the present dataset, polypharmacy was significantly associated with PIP. However, polypharmacy itself should not automatically be considered irrational prescribing; several medicines may be appropriate when they have evidence-based indications. The clinical goal should therefore be to distinguish appropriate polypharmacy from unnecessary or inappropriate medication burden.

Antibiotics were prescribed in 48.0% of records. This frequency is relevant to antimicrobial stewardship, but the present dataset did not contain sufficient information regarding indication, microbiological findings, antibiotic selection, dose, duration or route. Therefore, antibiotic prescribing frequency alone cannot be interpreted as inappropriate antibiotic use.

PPI use was recorded in 58.8% of records. PPIs are effective when appropriately indicated, but indication and duration should be periodically reviewed, particularly when treatment is continued beyond the clinically required period. Similarly, NSAIDs were prescribed in 29.5% of records. Their use requires consideration of age, gastrointestinal risk, renal function, cardiovascular disease and concomitant medicines.

FDCs were present in 28.8% of records. FDCs can simplify treatment and potentially improve adherence when the combination is rational and the dose ratios are appropriate. Conversely, irrational combinations may increase unnecessary exposure or complicate dose adjustment. The present dataset did not contain sufficient drug-level detail to classify FDCs as rational or irrational.

The mean recorded generic-prescribing percentage was $56.21 \pm 17.47\%$. This value should be interpreted as the average patient-level percentage recorded in the dataset; it should not be described as the proportion of all medicines prescribed by generic name unless a medicine-level denominator has been verified.

PIP was identified in 12.0% of records. The most striking descriptive finding was the concentration of PIP among patients aged ≥ 65 years: 52.7% of records in this age group were classified as PIP, whereas no PIP was recorded among younger patients. This pattern is clinically plausible because older adults are more likely to have multimorbidity and complex medication regimens. Nevertheless, because the analytical dataset does not document the individual PIP criteria, the magnitude and interpretation of this association depend on verification of the original PIP assessment method.

The association between polypharmacy and PIP was also statistically significant, with PIP occurring in 23.0% of records with polypharmacy compared with 5.6% without polypharmacy. This finding supports targeted medication review in patients exposed to higher medication burden. However, the cross-sectional nature of the analysed records does not establish causality.

Overall, the findings support structured medication review, particularly among older adults and patients receiving multiple medicines. PIP classification should be interpreted as a screening or quality-improvement construct rather than proof that an individual prescription was clinically wrong, because patient-specific indications and treatment priorities may modify the appropriateness of a medicine.

CLINICAL IMPLICATIONS

1. Medication review should be prioritized for patients receiving five or more medicines, particularly older adults.
2. Periodic review of PPI and NSAID use may identify opportunities for deprescribing or safer alternatives where clinically appropriate.
3. Antibiotic prescriptions should be assessed against indication, dose, duration and local antimicrobial stewardship policies rather than frequency alone.
4. Generic prescribing can be strengthened through institutional prescribing policies, educational interventions and prescription audits.
5. Clinical pharmacology and pharmacy services can contribute to medication reconciliation, identification of potential drug-related problems and review of high-risk prescriptions.

STRENGTHS OF THE STUDY

5. The study included 400 patient records.
6. The study covered a complete 12-month period.
7. Multiple clinical departments were represented.
8. Several practical prescribing indicators were evaluated simultaneously.
9. The relationship between polypharmacy and PIP was statistically assessed.
10. Department-specific descriptive information was provided for future prescription-audit planning.

LIMITATIONS

11. The retrospective design limits inference regarding causal relationships between patient characteristics and prescribing outcomes.
12. The study was conducted at a single tertiary care centre; therefore, generalizability to other settings may be limited.
13. The analytical dataset did not contain complete drug-level information such as individual drug names, doses, duration of therapy, route of administration and ATC codes; consequently, detailed ATC/DDD-based utilization analysis could not be performed.
14. The exact drug-specific criteria used to classify PIP were not documented in the analytical dataset and must be verified against the original protocol/source records before submission.
15. The study did not evaluate clinical outcomes such as adverse drug reactions, hospitalization, treatment failure or mortality.
16. The appropriateness of antibiotic, PPI and NSAID use could not be determined solely from their presence in a prescription.
17. Potential confounding by disease severity, clinical indication and comorbidity burden could not be fully addressed using the available retrospective variables.

RECOMMENDATIONS

18. Routine medication review for patients receiving five or more medicines.
19. Particular attention to patients aged ≥ 65 years.
20. Periodic audit of PPI and NSAID utilization with assessment of indication and duration.
21. Strengthening of institutional antibiotic stewardship practices.
22. Promotion of generic prescribing.

23. Regular review of fixed-dose combinations for therapeutic rationality.
24. Structured prescribing-audit programmes involving pharmacologists, pharmacists and clinicians.
25. Use of a validated prescribing-appropriateness instrument, selected in accordance with the study population and protocol.
26. Future prospective or multicentre studies incorporating drug names, doses, duration, clinical indications and treatment outcomes.
27. Development of a standardized institutional medication-review checklist.

CONCLUSION

This retrospective observational study demonstrated important patterns of medicine utilization among patient records from a tertiary care centre. Polypharmacy was present in 37.0% of records, while antibiotics, PPIs, NSAIDs and FDCs were prescribed in 48.0%, 58.8%, 29.5% and 28.8% of records, respectively. The mean recorded patient-level generic-prescribing percentage was 56.21%.

PIP was identified in 12.0% of records and showed strong statistical associations with older age and polypharmacy. Patients with PIP received a greater mean number of medicines than those without PIP. These findings support systematic medication review, particularly for older adults and patients exposed to complex treatment regimens.

Ethical Considerations

The study was conducted after obtaining approval from the Institutional Ethics Committee of the participating institution. As this was a retrospective record-based study involving routinely collected clinical data, individual informed consent was waived in accordance with institutional and ethical requirements.

DECLARATIONS

Consent for Publication

Not applicable, provided that no individually identifiable patient information is reported.

Data Availability

The data used for the present analysis were derived from institutional patient records. Data availability is subject to institutional policy and applicable ethical requirements.

Conflict of Interest

The authors declare no conflict of interest.

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No external funding was received for this study.

Author Contributions

The author(s) contributed to the conception of the review, literature search, interpretation of evidence, manuscript preparation, critical revision, and approval of the final manuscript.

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