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Antibiotic Prescribing Practices at a Tertiary Care Hospital in New Delhi: From Awareness to Action

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ABSTRACT

Background: Irrational antibiotic prescribing remains a major challenge in healthcare systems, particularly in developing countries, contributing to adverse drug reactions, antimicrobial resistance, and increased treatment costs. Antibiotic prescription analysis using National Health Mission (NHM) prescription guidelines and World Health Organization (WHO) indicators provides a standardized approach to evaluate and improve prescribing practices.
Objectives: To assess changes in antibiotic prescribing practices and rational drug use following antimicrobial resistance (AMR) stewardship and Good Prescription Practice (GPP) training in a tertiary-care teaching hospital. Methods: This was a data mining cross-sectional study analyzing the antibiotic prescription practices of the clinicians across the Hamdard Institute of Medical Science and Research, New Delhi. Prescriptions were assessed for completeness, legibility, and prescription trends using the NHM prescription guidelines and WHO core drug use indicators. Statistical comparisons across analysis cycles were performed.
Results: A total of 1,190 prescriptions were evaluated. Prescription completeness and documentation of clinical details improved significantly across the study period. Diagnosis recording increased from 49.0% in the year 2023 to 78.2% in 2025, while follow-up advice documentation increased from 33.0% to 83.3% ($p<0.001$). Legible handwriting improved to 100% by 2025. The average number of drugs per prescription remained stable (3.44 to 3.33), indicating no major change in polypharmacy. Generic prescribing increased from 4.47% to 29.21% ($p<0.001$). Antibiotic use rose transiently in the year 2024 but declined in 2025. Injectable use and emergency-drug-list prescribing decreased significantly. Patient-care indicators, including consultation time, dispensing quality, labelling, and patient knowledge, showed marked improvement.
Conclusion: Structured antibiotic prescription analysis combined with antimicrobial stewardship and good prescription practices training significantly improve prescription quality, rational drug use, and patient-care indicators, supporting their routine integration into hospital practice.

Keywords: *Antibiotic awareness; WHO core drug use indicators; antimicrobial stewardship; good prescription practices; rational drug use; NHM prescription guidelines.*

INTRODUCTION

Prescribing medication is an integral part of quality healthcare. In India, prescription laws have been laid out in the The Pharmacy Act, 1948. Although these laws are in place, inappropriate prescription practices can still be found. Inappropriate prescribing patterns increase the risk of adverse drug reactions, drug interactions as well as the mortality, morbidity and the cost of treatment. [1] These risks can be decreased by constant evaluation of drug prescriptions. [1] Evaluation of drug prescriptions comprises studies of drug utilization, emphasizing primarily on the rational use of medicine. It is a vital part of patient care and serves as a measure of quality of the care being provided. [1]

The problem of irrational drug use is very much prevalent across the globe and is especially prevalent and worse in developing countries [2]. It is estimated that up to 50% of prescriptions are prescribed irrationally [2]. There could be various causes behind irrationality of drug use, to name some: lack of knowledge and promotion of certain pharmaceutical companies. [2] This is especially problematic where antibiotics are concerned. It is a known fact that overuse of antibiotics leads to anti-microbial resistance [3]. All these issues make it imperative that an analysis and monitoring of prescriptions be done, to mitigate the consequences.

A prescription is a written medicolegal document by an authorized person for the treatment of the patient. [4] Analyzing prescriptions is a well-recognized tool used to monitor and improve quality of prescription. [5] Prescribing practices were evaluated using the World Health Organization (WHO) core drug use indicators. [6]

With this background this study was planned to do a comparative analysis of antibiotic prescription practices to evaluate the impact of antimicrobial stewardship (AMS) and training on good prescription practices (GPP).

MATERIALS AND METHODS

This was a data mining cross-sectional study. The antibiotic prescription practices of the clinicians across the various departments at Hamdard Institute of Medical Science and Research, New Delhi, were evaluated. The prescriptions were evaluated through the hospital information system (HIS) at different time intervals. The antibiotic prescriptions were assessed for completeness and legibility based on National Health Mission (NHM) prescription guidelines by government of India and for prescription trends using WHO core drug use indicators. The primary objective of the study was to assess changes in antibiotic prescribing practices following antimicrobial stewardship (AMS) and Good Prescription Practice (GPP) training in the hospital. Statistical comparisons across analysis cycles at different time intervals were performed.

Assessment by NHM prescription guidelines comprised of *Completeness of prescriptions*: This includes details like patient and doctor information, diagnosis, legibility, dose and duration of treatment, and prescriber's signature and registration number. *Diagnosis*: Accurate diagnosis is vital for appropriate treatment. *Legibility of prescriptions*: Clear and legible prescriptions are essential for dispensing accuracy. *Patient demographics and clinical details*: Recording age, gender, weight (especially in children), and relevant medical history.

Assessment by WHO Core Drug Use Indicators comprised of *Average number of drugs per prescription*: This indicator, calculated by dividing the total number of prescribed drugs by the number of encounters, helps assess whether a patient is receiving a reasonable number of medications. Fixed-dose combinations are counted as one drug. *Percentage of drugs prescribed by generic name*: This indicator, calculated as the ratio of drugs prescribed by generic name to the total number of drugs prescribed, is crucial for promoting cost-effective and accessible healthcare. *Percentage of antibiotics per prescription*: This indicator, calculated based on the WHO model list for antibiotic classification, helps monitor antibiotic use and identify potential overuse or misuse. *Percentage of injections per prescription*: This indicator helps assess the appropriateness of injectable medication use, excluding vaccinations. *Percentage of drugs prescribed from the Essential Drug List (EDL)*: This indicator ensures that prescribed medications are readily available and align with recommended treatment guidelines.

RESULTS

A total of 1,190 antibiotic prescriptions were analyzed. Table 1 shows completeness of patient information improved from 99.2% in the year 2023 to 100% in 2025. Improvements were observed in correct dose, duration, and frequency documentation. Prescription completeness improved across the three cycles, especially for medical details, indicating the positive effect of Antimicrobial Resistance Stewardship and training. General patient details (like name, age, sex, OPD number, date) were almost complete in 2023 and reached 100% in 2024 and 2025. Handwriting legibility dipped in 2024 but rose to 100% by 2025.

Clinical content improved markedly over time. Documentation of examination, diagnosis, and investigations increased substantially by 2025. Correct dose, formulation, frequency, and duration all showed large improvements after the AMS

and GPP training and follow-up advice increased from 33% to over 80%. In contrast, referral details and "do's and don'ts" declined, highlighting persistent gaps in counselling and coordination of care. Prescriber identification (signature and registration number) remained high throughout and approached 99% by 2025.

Table 1. Antibiotic Prescription Practices based on NHM Guidelines

Parameter		2023 (n=600) n (%)	2024 (n=200) n (%)	2025 (n=390) n (%)	p-value
General Details	Patient name	599 (99.8)	200 (100)	390 (100)	0.12
	Age	599 (99.8)	200 (100)	390 (100)	0.12
	Sex	599 (99.8)	200 (100)	390 (100)	0.12
	OPD registration number	595 (99.2)	200 (100)	390 (100)	0.04
	Date of consultation	599 (99.8)	200 (100)	390 (100)	0.12
	Legible handwriting	547 (91.1)	129 (64.5)	390 (100)	<0.001
Medical Details	History recorded	557 (92.8)	200 (100)	384 (98.5)	<0.001
	Examination	319 (53.2)	82 (41.0)	362 (92.8)	<0.001
	Diagnosis	294 (49.0)	119 (59.5)	305 (78.2)	<0.001
	Investigations	334 (55.7)	168 (84.0)	311 (79.8)	<0.001
	Correct dose	277 (46.2)	198 (99.0)	351 (90.0)	<0.001
	Correct formulation	277 (46.2)	198 (99.0)	349 (89.5)	<0.001
	Correct frequency	277 (46.2)	198 (99.0)	351 (90.0)	<0.001
	Correct duration	490 (81.7)	111 (55.5)	345 (88.5)	<0.001
	Follow-up advice	198 (33.0)	111 (55.5)	325 (83.3)	<0.001
	Referral details	–	82 (41.0)	56 (14.4)	<0.001
	Do's and Don'ts	223 (37.2)	70 (35.0)	123 (31.5)	0.18
	Legible signature	565 (94.2)	185 (92.5)	386 (98.9)	<0.01
	Medical council registration no.	555 (92.5)	187 (93.5)	385 (98.7)	<0.01

We see in Table 2 that prescribing indicators showed limited change in polypharmacy, but substantial shifts were noted in generic use and antimicrobial prescribing over the cycles. The average number of drugs per prescription remained relatively stable (3.44 in 2023, 3.0 in 2024, 3.33 in 2025). Prescribing by generic name increased sharply from 4.47% in 2023 to 37.6% in 2024, then declined to 29.21% in 2025, remaining far below the WHO reference of 100%. The proportion of prescriptions containing antimicrobials rose from 16.94% to 38.9% in 2024 before falling to 18.1% in 2025, suggesting a transient surge in antibiotic use despite stewardship efforts. Use of injections and drugs from the emergency drug list decreased over time, indicating more rational use of these modalities.

Patient-care indicators, available from 2024 onward, improved between 2024 and 2025. Average consultation time increased from 5.2 to 7.3 minutes, and dispensing time from 3 to 4.59 minutes, while patients' knowledge of correct dosage increased from 55% to 87.5%, reflecting more time devoted to patient interaction and counselling. The percentage of drugs actually dispensed rose from 60% to 87.65%, and adequate labelling improved from 45% to 100%.

Table 2. Antibiotic Prescription Practices based on WHO Core Drug Use Indicators

WHO Core Drug Use Indicator		2023 (n=600)	2024 (n=200)	2025 (n=390)	p-value
Prescribing indicators	Average number of drugs per prescription	3.44	3.00	3.33	0.21
	Drugs prescribed by generic name (%)	4.47	37.6	29.21	<0.001
	Prescriptions with antimicrobials (%)	16.94	38.90	18.10	<0.001
	Prescriptions with injections (%)	6.85	0	3.23	<0.001
	Drugs from emergency drug list (%)	51.09	0.50	0.67	<0.001
Patient-care indicators	Average consultation time (min)	–	5.2	7.3	<0.001
	Average dispensing time (min)	–	3.0	4.59	<0.001
	Drugs actually dispensed (%)	–	60.0	87.65	<0.001
	Drugs adequately labelled (%)	–	45.0	100	<0.001
	Patients knowing correct dosage (%)	–	55.0	87.5	<0.001

Table 3 details comparison between department wise prescriptions at the start and end of the study, i.e, for years 2023 and 2025. Serial analysis of 990 prescriptions (2023: n=600; 2025: n=390) across four departments—Medicine & Allied (n=209,110), Surgery & Allied (n=227,160), Obstetrics & Gynecology (OBG) (n=76,60), and Pediatrics (n=88,60)—demonstrated significant improvements in prescription completeness and rational prescribing practices.

Essential general details including patient name, age, sex, OPD registration number, and consultation date were documented in ≥98.8% of prescriptions in both cycles. Legible handwriting improved from 99.4% to 100% in Medicine & Allied and Surgery & Allied, while Obstetrics & Gynecology (OBG) showed the most substantial gain (83.3% to 100%). Prescriber signature legibility and Medical Council registration numbers reached ≥96.4% completeness.

Clinical documentation exhibited marked enhancement. Examination findings improved from 34.3% to 84.5% (Medicine & Allied), 59.4% to 99.3% (Surgery & Allied), and 38.3% to 80% for diagnosis in OBG. Follow-up advice documentation increased substantially across departments (20-33.9% to 76.3-86.9%). Drug prescription parameters remained consistently high (≥84.3% for dose, formulation, frequency).

WHO core drug use indicators revealed reduced polypharmacy (Medicine & Allied: 4.83 to 3.92 drugs/prescription) and increased generic prescribing (Pediatrics: 16.13% to 49.53%). Patient-care indicators (2025) showed average consultation times of 6.8-8.18 minutes, 90-100% adequate drug labelling, and 80-100% patient dosage knowledge. These findings underscore the effectiveness of analysis-feedback cycles in enhancing prescription quality.

Table 3. Department-wise comparison of prescription completeness before and after interventions (2023 vs 2025)

	Medicine & Allied			**Surgery & Allied**			**Obstetrics & Gynecology (OBG)**			**Pediatrics**		
Parameter	**2023 N=209 n(%)**	**2025 N=110 n(%)**	**p-value**	**2023 N=227 n(%)**	**2025 N=160 n(%)**	**p-value**	**2023 N=76 n(%)**	**2025 N=60 n(%)**	**p-value**	**2023 N=88 n(%)**	**2025 N=60 n(%)**	**p-value**
Patient name	208 (99.4)	110 (100)	0.48	227 (100)	160 (100)	–	76 (100)	60 (100)	–	88 (100)	60 (100)	–
Age	209 (100)	110 (100)	–	227 (100)	160 (100)	–	76 (100)	60 (100)	–	88 (100)	60 (100)	–
Sex	209 (100)	110 (100)	–	227 (100)	160 (100)	–	76 (100)	60 (100)	–	88 (100)	60 (100)	–
OPD registration no.	207 (98.8)	110 (100)	0.24	227 (100)	160 (100)	–	76 (100)	60 (100)	–	88 (100)	60 (100)	–
Date of visit	209 (100)	110 (100)	–	227 (100)	160 (100)	–	76 (100)	60 (100)	–	88 (100)	60 (100)	–
Legible handwriting	208 (99.4)	110 (100)	0.48	226 (99.4)	160 (100)	0.32	63 (83.3)	60 (100)	0.002	88 (100)	60 (100)	–
History	186 (89.2)	104 (94.5)	0.18	222 (97.8)	160 (100)	0.08	76 (100)	60 (100)	–	84 (95.7)	60 (100)	0.12
Examination	72 (34.3)	93 (84.5)	<0.001	135 (59.4)	159 (99.3)	<0.001	76 (100)	56 (93.3)	0.04	87 (98.6)	54 (90.0)	0.03
Diagnosis	122 (58.4)	90 (81.8)	<0.001	115 (50.5)	123 (76.9)	<0.001	29 (38.3)	48 (80.0)	<0.001	7 (8.5)	44 (73.3)	<0.001
Investigations	107 (51.2)	84 (76.3)	<0.001	129 (56.7)	132 (82.5)	<0.001	41 (53.3)	52 (86.7)	<0.001	40 (45.7)	43 (71.7)	0.003
Correct dose	176 (84.3)	99 (90.0)	0.22	211 (92.8)	135 (84.3)	0.01	75 (98.3)	59 (98.3)	–	88 (100)	58 (96.7)	0.12
Correct formulation	176 (84.3)	99 (90.0)	0.22	211 (92.8)	135 (84.3)	0.01	75 (98.3)	57 (95.0)	0.31	88 (100)	58 (96.7)	0.12
Correct frequency	176 (84.3)	99 (90.0)	0.22	211 (92.8)	135 (84.3)	0.01	75 (98.3)	59 (98.3)	–	88 (100)	58 (96.7)	0.12
Correct duration	188 (89.8)	99 (90.0)	0.96	202 (88.9)	135 (84.3)	0.22	42 (55.0)	53 (88.3)	<0.001	70 (80.0)	58 (96.7)	0.01

Follow-up advice	62 (29.5)	84 (76.3)	<0.001	77 (33.9)	139 (86.9)	<0.001	18 (23.3)	52 (86.7)	<0.001	18 (20.0)	50 (83.4)	<0.001
Referral details	25 (12.0)	6 (5.5)	0.04	1 (0.5)	33 (20.6)	<0.001	10 (13.3)	13 (21.7)	0.24	5 (5.7)	4 (6.7)	0.83
Do's & Don'ts	45 (21.7)	20 (18.2)	0.47	100 (43.9)	58 (36.2)	0.15	20 (26.7)	22 (36.7)	0.26	68 (77.1)	23 (38.3)	<0.001
Legible signature	209 (100)	106 (96.4)	0.04	227 (100)	160 (100)	–	61 (80.0)	60 (100)	<0.001	87 (98.6)	60 (100)	0.36
Medical council redg. no.	205 (98.2)	106 (96.4)	0.34	227 (100)	159 (99.4)	0.41	15 (20.0)	60 (100)	<0.001	87 (98.6)	60 (100)	0.36

DISCUSSION

The objective of this study was to assess the antibiotic prescription practices over different time intervals and to assess the effectiveness of antimicrobial stewardship (AMS) programs and good prescription practice (GPP) training in improvement of prescription practices. Prescription analysis is a validated, standardized tool in monitoring the quality of prescribing practices in any institution. [6] Prescription analysis helps identify areas where drug use is appropriate and thus promotes the rational use of medicines [7,8]. By analyzing prescribing patterns, we can highlight areas of drug misuse, thereby enhancing patient safety and cost savings by reducing unnecessary prescriptions. [9] In the present study, this was reflected by the significant improvement in prescription completeness, legibility, documentation of diagnosis, investigations, and follow-up advice across all three analysis cycles. This may be attributed to robust implementation and training on antimicrobial stewardship (AMS) introduced in the hospital for all clinicians as well as healthcare professionals (nursing staff, technicians, pharmacists). This was followed by regular training and hands-on workshops on Good Prescription Practice (GPP) for the clinicians and medical students (Table 1).

A study from Maharashtra, India done in 2003, found that the prescription analysis is an important tool to improve quality of healthcare in hospitals [10]. In the same study, it was found that, based on the number of drugs per prescription, 31% could be categorized as irrational, which means 4 or more drugs per prescription. In our results, the average number of drugs per prescription remained stable (3.44 in 2023, 3.00 in 2024 and 3.33 in 2025) (Table 2), indicating that although polypharmacy was not markedly reduced, it was maintained within WHO-recommended limits. The temporary reduction in 2024 may be attributed to the AMS program, which briefly touched on the topic of polypharmacy and rational antimicrobial use.

Another study from Eastern India showed that, while the number of drugs per prescription was within the range recommended by WHO guidelines, it was still on the higher end of the spectrum. This shows a tendency towards polypharmacy. [11] A similar pattern was seen in our study, where mean drug count remained around 3.3 per prescription across all years, suggesting scope for further improvement in minimizing unnecessary medications.

A study was conducted in France that studied the impact of training pharmacy residents in the field of prescription analysis. It was found that the program significantly improved their performance [12]. In our study as well, improvement was seen after the introduction of GPP training and AMS programs especially in the documentation of examination, diagnosis, investigations, correct dose, frequency, duration, and follow-up advice (Table 1 and Table 3).

In a study published in 2013, Jhalawar, found an improvement in prescription behavior after implementing serial analysis and active feedback. [13] Discontinuation of the surveys resulted in reversal of improvement. Our study also found improvements in prescription practice on conducting serial surveys, as shown by the increase in legibility from 64.5% in 2024 to 100% in 2025, and the rise in follow-up advice from 33.0% in 2023 to 83.3% in 2025 (Table 1). However, no follow-up assessments were done to determine whether discontinuation of surveys had a negative impact.

A total of 1,190 prescriptions were collected in the three serial cycles, of which 600 were from 2023, 200 from 2024 and 390 from 2025. The department-wise distribution showed that Surgery and Medicine contributed the largest share of prescriptions in both 2023 and 2025. Although department-wise data for 2024 was missing, comparison between 2023 and 2025 showed statistically significant improvement across all four departments in examination, diagnosis, investigations, and follow-up advice (Table 3), with the greatest relative improvement observed in Pediatrics and OBG.

Completeness of prescription was noted under 2 headings- patient information and medical details. General patient information such as name, age, gender, OPD registration number and date of consultation were recorded in more than 99% of prescriptions in the 2023 cycle and 100% in both 2024 and 2025 (Table 1). This increase may be attributed to regular trainings and surveys on Good Prescription Practices (GPP) as well as Antimicrobial Stewardship hands-on trainings conducted by the Department of Pharmacology. It was observed that the percentage of prescriptions having

legible handwriting in 2023 was 91.1%, which dipped down to 64.5% in 2024, but soon shot back up and above to 100% in 2025.

In the medical details segment, 11 out of 13 parameters improved significantly from 2023 to 2025 (Table 1); while 2 parameters showed a drop in completeness, namely, Referral details and 'Do's and Dont's. Maximum improvement was seen in follow-up advice, correct frequency, duration, dose and formulation. This improvement, again, is attributed to the regular surveys and regulation of Good Prescription Practice (GPP) conducted by the Department of Pharmacology. An improvement was noted in prescription legibility, in the final cycle of the study, increasing from 91.1% to 100%.

An area that requires much improvement is prescription of drugs by generic name. In our study, generic prescribing increased from 4.47% in 2023 to 29.21% in 2025 (Table 2), but this remains far below the WHO ideal of 100%. This is consistent with findings from other Indian studies, where generic prescribing ranged from 22–30% [14]. Prescribing drugs by brand-name is a practice widely promoted by big pharmaceutical companies and their medical representatives. Doctors often fall prey to the marketing strategies of these medical representatives. As opposed to our results, a study conducted in Eastern India showed 75% of prescriptions were prescribed by generic names. [11] Differences in study settings may possibly account for such variation, as generic prescribing is found to be better in public compared to private healthcare settings.[15]

In terms of WHO core drug-use indicators, the percentage of drugs prescribed by generic name improved significantly, while antibiotic prescribing showed a transient rise in 2024 (38.9%) before declining to 18.1% in 2025 (Table 2). The rise in 2024 may be attributed to COVID-19 and other infectious disease surges, rather than failure of stewardship. The relatively stable average number of drugs per prescription indicates no clinically significant change in polypharmacy.
For health-facility indicators, a significant reduction in injectable use and drugs from the emergency drug list was observed after interventions (Table 2), indicating more rational and guideline-based prescribing.

Finally, for patient-care indicators, average consultation time increased from 5.2 minutes in 2024 to 7.3 minutes in 2025, and dispensing time from 3.0 to 4.59 minutes. The percentage of drugs dispensed, adequately labelled, and patients knowing correct dosage also improved significantly (Table 2). These improvements reflect better clinician-patient communication, pharmacy practice, and adherence to good prescription practices.

Strengths and Limitations
Large sample size and consistent trends across multiple indicators strengthen the validity of our findings [7,11]. However, the study had some limitations consistent with HIS based data mining studies such as incomplete data, investigators bias and inability to perform root cause analysis and take corrective action.

CONCLUSION

This antibiotic prescription analysis demonstrates that structured surveying combined with antimicrobial stewardship (AMS) program and Good Prescription Practice (GPP) training leads to significant and sustained improvements in prescription quality and rational drug use. Marked gains were observed in prescription completeness, legibility, documentation of diagnosis, investigations, and follow-up advice across all clinical departments. While polypharmacy remained stable, significant improvement in generic prescribing and rationalization of injectable and emergency-drug-list medicines was achieved. Patient-care indicators such as consultation time, dispensing quality, labelling, and patient knowledge of correct dosage also improved substantially. However, generic prescribing and antibiotic use remain suboptimal, indicating the need for continuous surveys, feedback, and policy-driven interventions to strengthen rational prescribing practices in tertiary-care settings.

Contributions: N.N. and T.A.K. conceived the study.
S.R., M.K., M.M., M.A.I., and S.M.K. collected and analyzed the data.
N.N. and T.A.K. drafted and revised the manuscript.
All authors approved the final version.

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