



Received on 03 June 2026; received in revised form, 29 June 2026; accepted, 08 July 2026; published 01 October 2026

PRESCRIPTION PATTERN ANALYSIS USING WHO AWARE GUIDELINE OF ANTIBIOTICS USED AMONG IN-PATIENTS IN DIFFERENT DEPARTMENTS OF A TERTIARY CARE HOSPITAL IN UPPER ASSAM - A CROSS-SECTIONAL STUDY

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Keywords:

Antibiotics, AWARe classification, Antimicrobial resistance, Prescription pattern, Rational drug use, Antimicrobial stewardship

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ABSTRACT: Background: Antimicrobial resistance (AMR) is largely caused by the irrational and inappropriate use of antibiotics. To encourage sensible antibiotic prescription and enhance antimicrobial stewardship, the WHO established the AWARe (Access, Watch, Reserve) categorization and also to uncover irrational prescribing practices. **Objectives:** To assess antibiotic prescribing patterns and compliance with WHO AWARe standards in several tertiary care hospital departments. **Material & Methods:** A cross-sectional observational study was conducted with in-patients admitted to the medical, dermatological, and psychiatric departments of the 'Assam Medical College and Hospital in Dibrugarh'. Using purposive sampling, 230 prescriptions that contained at least one antibiotic. Case record form was used to document demographic information, diagnosis, recommended antibiotics, mode of administration, length of therapy, and generic prescriptions. Antibiotics were categorized using the WHO AWARe classification, and Microsoft Excel's descriptive statistics were used to examine prescription indicators. **Results:** Antibiotics were given more frequently from the Watch group (56%) compared to the Access group (36%). Ceftriaxone (36.54%) as most commonly prescribed and other broad-spectrum antibiotics accounted for the majority of prescriptions and there was male (55.3%) preponderance in antibiotic consumption. Generic prescriptions revealed high adherence (91.35%) to WHO guideline, and the majority of antibiotics were administered parenterally (92.1%) and Department of Medicine (47.1%) with the highest prescription of antibiotics followed by Dermatology (43.4%) and Psychiatry (10.6%). The results showed indications of irrational antibiotic use together with a partial adherence to WHO AWARe recommendations. **Conclusion:** Various departments had inconsistent adherence to WHO AWARe standards and a preponderance of Watch group antibiotics. To lower antimicrobial resistance and enhance patient care, routine prescription audits, antimicrobial stewardship initiatives, and the encouragement of sensible antibiotic prescribing are essential.

INTRODUCTION: In healthcare antibiotics are commonly prescribed and have dramatically decreased the morbidity and mortality linked to infectious diseases.

However, the irrational and inappropriate application of antibiotics has led to the emergence of AMR, which is presently recognized as a major global public health concern.

Irrational antibiotic use includes over prescription, unnecessary use of antibiotics with broad spectrum, incorrect dosage and time frame, self-medication, including irrational fixed-dose combinations. Treatment failure, higher healthcare expenses, longer hospital stays, and higher mortality are all

QUICK RESPONSE CODE 	DOI: 10.13040/IJPSR.0975-8232.17(10).3146-53 This article can be accessed online on www.ijpsr.com
DOI link: https://doi.org/10.13040/IJPSR.0975-8232.17(10).3146-53	

consequences of these procedures^{1, 2, 3, 4}. AWaRe (Access, Watch, Reserve) classification was established by World Health Organization (WHO) in 2017 to encourage sensible antibiotic usage and combat anti-microbial resistance. Based on their recommended usage, resistance potential, and spectrum of activity, categorization of antibiotics is done by AWaRe framework. While the Watch group of antibiotics has a broader range of action and a higher potential for resistance, the Reserve group of antibiotics are considered last-resort drugs to treat illnesses that are resistant to numerous treatments, and the Access group of antibiotics are recommended as first-line treatment for common diseases. According to WHO recommendations, the Access group should account for at least 60% of all antibiotic consumption^{5, 6, 7, 8}.

Excessive usage of Watch group antibiotics and unreasonable hospital prescribing practices have been documented in a number of research carried out in India and other nations. In order to reduce antimicrobial resistance, these researches highlighted the necessity of conducting routine prescription audits, setting antimicrobial stewardship programs into place, and following AWaRe and WHO prescribing indicators^{1, 2, 5, 6, 9, 10, 11}.

Due to high volume of critically ill and infectious patients, tertiary care facilities are important hubs for the use of antibiotics. Depending on the disease profile and prescribing methods, different clinical departments may exhibit different patterns of antibiotic prescription. To identify illogical prescribing trends and assist antimicrobial stewardship efforts, it is crucial to evaluate department-wise antibiotic consumption utilizing the WHO AWaRe categorization. Thus, applying the WHO AWaRe classification, the current study was carried out to evaluate the pattern of antibiotic consumption in several departments at a tertiary care.

MATERIAL & METHODS: This cross-sectional investigation was conducted in the 'In-Patient Departments (IPDs) of Medicine, Dermatology and Psychiatry at Assam Medical College and Hospital in Dibrugarh, Assam' for a period of three months. Before the study started, the 'Institutional Ethics Committee (H) of the Assam Medical College and

Hospital in Dibrugarh granted ethical permission vide no. AMC/EC/2025/23'. Written informed consent was taken from patients and patient data was kept confidential throughout the study.

The study population comprised all in-patients admitted for the designated departments and were prescribed antibiotics at least once during their hospital stay. Patients of all ages and genders were included in the study. The study excluded women who were pregnant or nursing, prescriptions that did not contain antibiotics, repeat prescriptions, ICU patients and incomplete case records. As the study was limited to selected departments and did not employ probability sampling, the findings are intended to reflect antibiotic utilization patterns within the sampled population and should not be generalized to the entire inpatient population.

Assuming total antibiotic use among all drug classes as 17.5% (6) with 5% margin of error and 95% confidence interval, the sample size was calculated using the formula:

$$N = Z^2(pq)/d^2$$

After putting the values result comes to be 221 which was rounded to 230. The study participants were chosen using the purposive sampling technique. Following the participants' informed consent, data were gathered prospectively using a standardized case record form. The demographic parameter of patients, diagnosis, prescribed antibiotics, dose, frequency, mode of management, duration of treatment, as well as brand-name as well as generic prescriptions were each recorded.

Prescription trends were examined using WHO AWaRe (Access, Watch, Reserve) categorization and WHO prescribing indicators. The duration of antimicrobial treatment, the average quantity of antibiotics provided per hospital stay, the proportion of medicines prescribed under generic name, adherence to hospital formulary and WHO guidelines, and prescribing trends were all examined after classifying antibiotics using the AWaRe classification.

Antibiotic use was assessed using the 'Anatomical Therapeutic Chemical (ATC) and Defined Daily Dose (DDD)' classification systems. Descriptive statistics were used to assess the gathered data once

it was imported into Microsoft Excel. Tables and percentages were used to display the results. The formula for DDD/1000/DAY used was:

$$\frac{(\text{Total no. of dosage units prescribed} \times \text{Dose strength} \times 1000)}{(\text{DDD} \times \text{Duration of study} \times \text{Total sample size})^6}$$

RESULTS AND DISCUSSION: 230 prescriptions from the departments of Medicine, Dermatology, and Psychiatry at ‘Assam Medical

College and Hospital in Dibrugarh’ that contained at least one antibiotic were examined.

The majority of patients who used antibiotics were adults (45-63 years, 40.7%, **Table 1**), and Females (45.2%) were less likely than males (55.3%) to take antibiotics (**Table 2**). Similar Studies in Pakistan and India revealed same demographic results^{12, 13}.

Table 1: ANTIBIOTIC DISTRIBUTION BY AGE

Sl. no.	Antibiotics	1-18yr	19-44yr	45-63yrs	≥64 yrs	Total (%)
1	Ceftriaxone	8	51	39	16	114 (36.54)
2	Piperacillin-Tazobactam	3	25	33	13	74 (23.71)
3	Doxycycline	2	10	8	1	21 (6.73)
4	Linezolid	1	5	8	1	15 (4.81)
5	Cefotaxime	0	5	6	4	15 (4.81)
6	Meropenem	0	2	6	5	13 (4.17)
7	Azithromycin	0	3	2	6	11 (3.53)
8	Cotrimoxazole	0	4	2	1	7 (2.24)
9	Metronidazole	0	3	3	0	6 (1.92)
10	Tigecycline	0	0	3	3	6 (1.92)
11	Amikacin	0	1	2	2	5 (1.60)
12	Levofloxacin	0	0	4	1	5 (1.60)
13	Amoxicillin-clavulanate	0	1	3	0	4 (1.28)
14	Cefadroxil	0	3	1	0	4 (1.28)
15	Cefixime	0	2	1	1	4 (1.28)
16	Clindamycin	0	2	1	1	4 (1.28)
17	Clarithromycin	0	2	0	1	3 (0.96)
18	Minocycline	0	2	1	0	3 (0.96)
19	Ofloxacin	0	2	1	0	3 (0.96)
20	Rifaximin	0	1	2	0	3 (0.96)
21	Cefuroxime	0	0	2	0	2 (0.64)
22	Ciprofloxacin	0	1	1	0	2 (0.64)
23	Gentamicin	0	0	2	0	2 (0.64)
24	Norfloxacin	0	0	2	0	2 (0.64)
25	Imipenem	0	0	1	0	1 (0.32)
	Total%	14(4.2%)	125(37.9%)	134(40.7%)	56(17.02%)	329 (100)

TABLE 2: ANTIBIOTIC DISTRIBUTION AMONG PATIENTS BY GENDER

Sl. no.	Names of the antibiotic	Male	Female	Total
1	Ceftriaxone	61	53	114 (36.54)
2	Piperacillin-Tazobactam	42	34	74 (23.71)
3	Doxycycline	13	8	21 (6.73)
4	Linezolid	9	6	15 (4.81)
5	Cefotaxime	8	7	15 (4.81)
6	Meropenem	7	6	13 (4.17)
7	Azithromycin	5	6	11 (3.53)
8	Cotrimoxazole	4	3	7 (2.24)
9	Metronidazole	4	2	6 (1.92)
10	Tigecycline	3	3	6 (1.92)
11	Amikacin	2	3	5 (1.60)
12	Levofloxacin	4	1	5 (1.60)
13	Amoxicillin / Amoxicillin-clavulanate	2	2	4 (1.28)
14	Cefadroxil	1	3	4 (1.28)
15	Cefixime	3	1	4 (1.28)
16	Clindamycin	1	3	4 (1.28)
17	Clarithromycin	2	1	3 (0.96)
18	Minocycline	2	1	3 (0.96)

19	Ofloxacin	2	1	3 (0.96)
20	Rifaximin	2	1	3 (0.96)
21	Cefuroxime	1	1	2 (0.64)
22	Ciprofloxacin	1	1	2 (0.64)
23	Gentamicin	1	1	2 (0.64)
24	Norfloxacin	1	1	2 (0.64)
25	Imipenem	1	0	1 (0.32)
	Total %	182(55.3%)	149(45.2%)	329(100)

Among the most commonly recommended antibiotics in the current study were cephalosporins (38.46%), particularly third-generation cephalosporins like Ceftriaxone and Cefixime followed by Piperacillin-tazobactam, Meropenem, Linezolid, Cefotaxim, Azithromycin, Amoxicillin-clavulanic acid, Metronidazole, , and Doxycycline (**Table 1**), were among the other frequently recommended antibiotics. Studies from Northern India, Pakistan, tertiary care facilities, ENT inpatient studies, New Delhi, and respiratory infection investigations from India where Watch group antibiotics were predominant, all revealed similar results^{6, 12, 13, 14, 15, 16, 17}.

The bulk of prescriptions were for Watch group antibiotics (**Table 5**), followed by Access group

antibiotics, while Reserve antibiotics were administered very infrequently, according to the WHO AWaRe categorization. This implies that the usage of broad-spectrum antibiotics, which have a greater potential for resistance, is increasing. Studies from Pakistan, Northern India, Tanzania, Zambia, and the United Kingdom all showed similar results^{2, 5, 9, 12, 13}.

Most of the antibiotics in this trial were given intravenously. The Essential Medicines List (EML) did not include all prescribed antibiotics and generic prescriptions were very uncommon. Previous ENT inpatient and tertiary care hospital investigations reported similar findings^{14, 15}.

TABLE 3: DDD OF EACH ANTIBIOTIC WITH THE ATC CODE

Sl. no.	Antibiotic	ATC code	WHO DDD (g)	DDD/1000/day
1	Ceftriaxone	J01DD04	2	27.49
2	Piperacillin-Tazobactam	J01CR05	14	5.42
3	Doxycycline	J01AA02	0.1	8.5
4	Linezolid	J01XX08	1.2	4.78
5	Cefotaxime	J01DD01	4	0.8
6	Meropenem	J01DH02	3	2.11
7	Azithromycin	J01FA10	0.3	2.58
8	Cotrimoxazole	J01EE01	1.92	0.05
9	Metronidazole	J01XD01	1.5	0.24
10	Tigecycline	J01AA12	0.1	0.63
11	Amikacin	J01GB06	1	1.33
12	Levofloxacin	J01MA12	0.5	0.72
13	Amoxicillin / Amoxicillin-clavulanate	J01CR02	1	0.58
14	Cefadroxil	J01DB05	2	0.08
15	Cefixime	J01DD08	0.4	0.36
16	Clindamycin	J01FF01	1.2	0.21
17	Clarithromycin	J01FA09	1	0.05
18	Minocycline	J01AA08	0.2	0.19
19	Ofloxacin	J01MA01	0.4	0.43
20	Rifaximin	A07AA11	0.8	0.75
21	Cefuroxime	J01DC02	0.5	0.97
22	Ciprofloxacin	J01MA02	1	0.24
23	Gentamicin	J01GB03	0.24	0.34
24	Norfloxacin	J01MA06	0.8	0.19
25	Imipenem	J01DH51	2	0.21
	Total			59.25

‘ATC: Anatomic, Therapeutic, Chemical. DDD: Defined Daily Dose’

The DDD analysis showed a rise in the usage of antibiotics with a broad spectrum such as Ceftriaxone (27.49 DDD/1000/Day) followed by Doxycycline (8.5 DDD/1000/Day) and Piperacillin (5.42 DDD/1000/Day). The overall antibiotic consumption in this study was 59.25 DDD/1000/day. Direct comparison with many published studies is difficult because different denominators (DDD/100 bed -days, DDD/1000 patient days, or DDD/1000/inhabitants/days) have been used. However the result provides a standard

estimate of antibiotic utilization within the study population. Overall Ceftriaxone was most commonly prescribed antibiotic. In Dermatology its use was highest among patients with erythroderma and pemphigus vulgaris, while in psychiatry it was frequently prescribed in patients admitted with alcohol dependence with delirium or schizophrenia who had concurrent infectious condition. In the Medicine Department, Ceftriaxone was used across a broad spectrum of infectious conditions without a single predominant diagnosis.

TABLE 4: DEPARTMENT WISE DISTRIBUTION OF ANTIBIOTICS

S. no.	Name of Antibiotic	Dermatology	Psychiatry	Medicine	Total
1	Ceftriaxone	51	26	37	114
2	Piperacillin-Tazobactam	19	4	45	68
3	Doxycycline	15	1	10	26
4	Cefotaxime	1	0	15	16
5	Linezolid	8	0	11	19
6	Meropenem	9	1	7	17
7	Azithromycin	4	0	12	16
8	Metronidazole	2	0	5	7
9	Rifaximin	0	0	7	7
10	Cotrimoxazole	7	0	0	7
11	Amikacin	5	0	0	5
12	Ofloxacin	5	0	0	5
13	Tigecycline	4	0	0	4
14	Cefixime	2	0	1	3
15	Clindamycin	2	0	1	3
16	Levofloxacin	1	1	1	3
17	Norfloxacin	0	1	1	2
18	Amoxicillin-clavulanate	2	1	0	2
19	Minocycline	1	0	0	1
20	Cefadroxil	1	0	0	1
21	Cefuroxime	1	0	0	1
22	Clarithromycin	1	0	0	1
23	Gentamicin	1	0	0	1
24	Ciprofloxacin	0	0	1	1
25	Imipenem	0	0	1	1
Total		143(43.4%)	35(10.6%)	155(47.1%)	329(100%)

The departments of Medicine, Dermatology, and Psychiatry all showed differences in antibiotic prescribing practices with Department of Medicine

showing highest antibiotic prescribing (47.1%, **Table 4**) followed by Dermatology (43.4%) and Psychiatry (10.6%).

TABLE 5: CATEGORIZATION OF ANTIBIOTICS USING THE AWARE SYSTEM

Sl. no.	Antibiotic name	Antibiotic class	AWaRe category	Listed in EML
1	Ceftriaxone	Third generation cephalosporin	Watch	Yes
2	Piperacillin-Tazobactam	Antipseudomonal penicillin + β -lactamase inhibitor	Watch	Yes
3	Doxycycline	Tetracycline	Access	Yes
4	Linezolid	Oxazolidinone	Reserve	Yes
5	Cefotaxime	Third generation cephalosporin	Watch	Yes
6	Meropenem	Carbapenem	Watch	Yes
7	Azithromycin	Macrolide	Watch	Yes
8	Cotrimoxazole	Sulfonamide combination	Access	Yes
9	Metronidazole	Nitroimidazole	Access	Yes
10	Tigecycline	Glycylcycline	Reserve	No

11	Amikacin	Aminoglycoside	Access	Yes
12	Levofloxacin	Fluoroquinolone	Watch	Yes
13	Amoxicillin / Amoxicillin-clavulanate	Aminopenicillin + β -lactamase inhibitor	Access	Yes
14	Cefadroxil	First generation cephalosporin	Access	No
15	Cefixime	Third generation cephalosporin	Watch	Yes
16	Clindamycin	Lincosamide	Access	Yes
17	Clarithromycin	Macrolide	Watch	No
18	Minocycline	Tetracycline	Access	No
19	Ofloxacin	Fluoroquinolone	Watch	No
20	Rifaximin	Rifamycin derivative	Watch	No
21	Cefuroxime	Second generation cephalosporin	Watch	Yes
22	Ciprofloxacin	Fluoroquinolone	Watch	Yes
23	Gentamicin	Aminoglycoside	Access	Yes
24	Norfloxacin	Fluoroquinolone	Watch	No
25	Imipenem	Carbapenem	Watch	Yes

Access group: 36%, Watch group: 56%, Reserve group: 8%.

The current study evaluated antibiotic prescribing behaviors in multiple departments in a tertiary care hospital using the WHO AWaRe classification. The study showed that Watch group drugs were more common (56%, **Table 5**) than Access group medicines, suggesting a partial disregard for WHO guidelines as well as an increase in the use of broad-spectrum antibiotics. Watch group antibiotics used were 14 followed by Access group

that were 9 and Reserve group were 2 in number. To reduce antimicrobial resistance, According to WHO recommendations, the Access group should account for at least 60% of antibiotic use. Nonetheless, the current study revealed a rise in the use of Watch group antibiotics, which is similar to research done in Pakistan, Zambia, Tanzania, the UK, Northern India, and urban outpatient settings in India ^{2, 5, 9, 12, 13, 17}.

TABLE 6: HOSPITAL PRESCRIBING FACTORS FOR THE USE OF ANTIBIOTICS

Sl. no.	Name of the indicator	Result
1	Percentage of antibiotics supplied in accordance with the hospital's formulary list	88.46%
2	Average duration (in days) of prescribed antimicrobial treatment	6.8 days
3	Percentage of antibiotics administered using generic names	91.35%
4	The average quantity of antibiotics provided during a hospital stay	1.36
5	Percentage of encounters with injectables	92.11%

TABLE 7: USAGE OF ANTIBIOTICS ACCORDING TO ROUTE OF ADMINISTRATION

Route	Number of encounters	Percentage %
Oral	15	6.5
Parenteral	212	92.1
Others(Topical)	3	1.3
Total	230	100

In this study, generic prescriptions were satisfactory (91.35%, **Table 6**). In order to lower treatment costs and encourage sensible drug usage, WHO strongly advises generic prescribing. Current study is consistent with studies from New Delhi and ENT departments which showed improved adherence to generic prescribing procedures ^{15, 16}.

Parenteral (92.1%) usage of antibiotics were much more than oral (6.5%), that exceeds the WHO guidelines which states to keep parenteral usage under 10%, followed by topical (1.3%). The current study evaluated the pattern of antibiotic use in multiple departments in a tertiary care hospital

utilizing the WHO AWaRe classification. The study showed that Watch group drugs were more common than Access group medicines, suggesting a partial disregard advocating an increase in the utilization of broad-spectrum antibiotics and WHO recommendations.

Injectable versions of third-generation cephalosporins were widely utilized, and they were among the most commonly prescribed antibiotics. Antibiotic prescribing trends varied among departments, and generic prescribing was quite low.

TABLE 8: COMMON DEPARTMENT WISE INDICATIONS FOR ANTIBIOTIC USE

Sl. no.	Department	No. of prescriptions	Common indications for antibiotic use
1.	Dermatology	90	Predominantly autoimmune blistering disorders (especially pemphigus vulgaris) and severe inflammatory dermatoses with secondary infection risk
2.	Psychiatry	36	Psychiatric illnesses complicated by fever, delirium, UTI, pneumonia, suspected neuroleptic malignant syndrome and other intercurrent infections
3.	Medicine	104	Urinary tract infections (especially Pyelonephritis), respiratory infections, sepsis, CKD-associated infections, and chronic liver disease-related infections.

The results indicates the existence of somewhat less logical antibiotic prescribing patterns, which could be a factor in the development and dissemination of antimicrobial resistance. Regular prescription audits, adherence to WHO AWaRe guidelines, promotion of generic prescription, implementing antimicrobial stewardship initiatives is essential to enhancing sensible antibiotic use and optimize patient care in tertiary care hospitals.

Department wise assessment of antibiotic prescribing trends using AWaRe classification was one of the study's main strengths. Prescribing indicators evaluation and trends in antibiotic use added valuable information about antibiotic use.

This study employed purposive sampling and included only selected inpatient departments over a period of three months. Therefore, the findings may not represent overall inpatient antibiotic utilization across the entire hospital. Small sample size and short length of the study in a single tertiary care institution limits how far results may be applied. Microbiological culture and sensitivity reports were not taken into account and long term clinical effects of antibiotic therapy could not be assessed. However despite these limitations, the study provides baseline information about antibiotic use trends and proposes the necessity of ongoing surveillance and sensible prescription practices.

CONCLUSION: This study reveals how antimicrobial drugs are prescribed and used in different departments, and underlined significance of rational prescribing in promoting safe, efficient, and cost-effective therapy which helps to minimize antimicrobial resistance, adverse drug reactions and treatment costs. Shortcomings in prescription methods, such as frequent application of broad-spectrum antibiotics and limited adherence to normal prescribing recommendations underscore the need for regular prescription audits and antibiotic stewardship initiatives in clinical

practice. The results may help physicians and policymakers in developing plans for encouraging rational medicine usage and improving antimicrobial prescription practices. Bigger population, multi-centric, long term studies are needed to improve evidence based medical practice.

ACKNOWLEDGEMENTS: Nil

CONFLICTS OF INTEREST: Nil

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How to cite this article:

Khan FI, Sarma G, Barua S, Dutta PK and Dutta SK: 'Prescription pattern analysis using who aware guideline of antibiotics used among in-patients in different departments of a tertiary care hospital in upper Assam - a cross-sectional study'. *Int J Pharm Sci & Res* 2026; 17(10): 3146-53. doi: 10.13040/IJPSR.0975-8232.17(10).3146-53.

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