fortune Journals

Research Article

JOURNAL OF PHARMACY AND PHARMACOLOGY RESEARCH

ISSN: 2578-1553

Evaluation of Antibiotics Prescribing Patterns at a Tertiary Care Teaching Hospital Using WHO AWaRe Classification

Damini Prajapati[1], Shah Megha H[*,2], Desai Chetna K[3]

Abstract

Antimicrobial resistance (AMR) is a global health challenge driven by the misuse and overuse of antibiotics. Two key initiatives taken by World Health Organization (WHO) to promote rational antibiotic use and address AMR include updating the Essential Medicines List (EML) and implementing the Access, Watch and Reserve (AWaRe) classification. This study aimed to assess the antibiotic prescribing patterns at a tertiary care teaching hospital. A 12-month observational, prospective study was conducted on indoor patients from the Medicine, Surgery, and Obstetrics & Gynecology wards. Data were collected on the 2nd and 7th days of antibiotic therapy. Antibiotic use was grouped into Access, Watch, Reserve and Not Recommended groups. The mean age of patients was 40.54 years (52% were female). A total of 983 antibiotics were prescribed among 600 patients, with the Watch group (59.82%) being the most common, followed by Access (31.64%) and Reserve group antibiotics(1.93%). Ceftriaxone was the most frequently prescribed antibiotic (24.42%). The Access to Watch ratio was 0.5. Empirical antibiotic use was high (42%), while 1.33% were based on culture sensitivity. Adherence to the NLEM was 90.69% in Medicine, 72.09% in Surgery, and 87.01% in Obstetrics & Gynecology. The study revealed a high reliance on Watch antibiotics, with ceftriaxone being the most prescribed.

Keywords: Antimicrobial resistance (AMR), AWaRe, Access, Watch, Reserve, W.H.O, A:W ratio

Introduction

Antimicrobial resistance (AMR) occurs when microorganisms become resistant to the effects of antimicrobial agents, posing a significant threat to global public health and economic stability. AMR is listed as one of the most critical global challenges by the World Health Organization (WHO) and responsible for 1.27 million deaths in year 2019. Each year 700000 people are dying world- wide due to AMR, the numbers may rise to 10 million in 2050. (1) In India, AMR was responsible for 297,000 deaths and associated with 1,042,500 deaths in 2019 [1]. Misuse and overuse of antibiotics in humans, animals, and plants lead to bacterial resistance, increased healthcare costs, longer hospital stays and higher morbidity and mortality [2].

Two key initiatives taken by WHO to address AMR include periodic updating the Essential Medicines List (EML) and implementing the Access, Watch and Reserve (AWaRe) classification to promote rational antibiotic use. WHO classifies key antibiotics into access, watch and reserve categories on the basis of their spectrum and propensity to develop resistance. Access group

Affiliation:

[1]Resident doctor, Department of Pharmacology, B.J. Medical College, Ahmedabad, Gujarat

[2]Assistant Professor, Department of Pharmacology, B.J. Medical College, Ahmedabad, Gujarat

[3]Professor and Head, Department of Pharmacology, B.J. Medical College, Ahmedabad, Gujarat

***Corresponding author:**
Shah Megha H, Department of Pharmacology, B.J. Medical College, Ahmedabad, Gujarat, India.

Citation: Damini Prajapati, Shah Megha H, Desai Chetna K. Evaluation of Antibiotics Prescribing Patterns at a Tertiary Care Teaching Hospital Using WHO AWaRe Classification. Journal of Pharmacy and Pharmacology Research 9 (2025): 36-44.

Received: February 16, 2025
Accepted: March 03, 2025
Published: April 07, 2025

Prajapati D, et al., J Pharm Pharmacol Res 2025
DOI:10.26502/fjppr.0107

antibiotics are recommended as essential first or second-choice empiric treatment options for common infectious syndrome and hence should be freely available. The watch group antibiotics are indicated for specific, limited number of infective syndromes while reserve group should be used as Last resort in selected patients and so require monitoring and are the main targets of the antimicrobial surveillance program [2]. The Strengthening Pharmaceutical Systems (SPS) Program also developed selected indicators for investigating antimicrobial use in hospitals. These indicators provide a simple tool for fast evaluation of critical aspects of antimicrobial use [3]. WHO aim is to have all countries report antibiotic use by the year 2023 and at least 60% of prescribed antibiotics should be from Access group. However, very limited data are available from India, particularly in the study area, regarding the antibiotic prescribing patterns based on WHO AWaRe classification among hospitalized patients. Thus, the present study conducted at a 2000 bedded tertiary care hospital, aimed to evaluate the prescribing pattern of antibiotics using the WHO AWaRe tool and selected core drug use indiciators for antimicrobial use in hospitals.

Materials and Methods

General

This observational, prospective, single-center study was conducted at a tertiary care teaching, Civil Hospital Ahmedabad (CHA) over 12 months from January 2023 to January 2024 to evaluate the prescribing patterns of antibiotics according to the WHO AWaRe classification. The study was carried out after taking approval from IEC of CHA (Ref.no. 06/2023). The study was carried out in adult patients admitted to the Medicine, Surgery, and Obstetrics & Gynaecology wards and prescribed systemic antibiotics. Patients admitted to ICU, prescribed only antifungals, antivirals, antihelminthics or topical antibiotics and refusing consent were excluded. In each department, patients from two units were included, with every alternate patient being enrolled, thus ensuring an uniform sampling. Data were collected on the 2nd and 7th day of antibiotic therapy. The details of patient demographics, diagnosis, prescribed antibiotics (group, dose, route, and frequency, brand / generic name), concomitant drugs and culture sensitivity reports were recorded on case record form and evaluated. Antibiotic use was grouped as per WHO classification (Access, Watch, Reserve, Not Recommended), A: W ratio and also other prescribing indicators evaluated. (4)

Antibiotics prescribed from NLEM (5th edition, 2022) or state ELM (5th edition 2022-2023) and also prescribed as empirical therapy, prophylaxis or on basis of culture sensitivity report also evaluated.

Selected Hospital indicators for drug use: [4]

Existence of an approved hospital formulary list or essential medicines list

Selected Prescribing indicators for drug use:

1. Average number of antimicrobials prescribed per hospitalization in which antimicrobials were prescribed Calculation: Number of antimicrobials prescribed for all hospitalizations ÷ Total number of hospitalizations with antimicrobials prescribed
2. Percentage of antimicrobials prescribed by generic name Calculation: Total number of antimicrobials prescribed by generic name × 100÷ Total number of antimicrobials prescribed.

Sample size calculation:

$$\frac{n=(Z\alpha/2)2}{d^2}\,p(1-p)$$

where n=required initial sample size, Zα/2=critical value for normal distribution at 95% confidence interval which equals 1.96. Estimated Proportion (P): we took the proportion (P) of 50% (0.5), which is a commonly used when there's no prior data. (q = 0.5). d=marginal error (4.5%2=0.002050). To increase the sample size, as recommended in the literature, we used 2.5−5%. (5) Considering a 25% dropout rate, the final sample size of the study was 600 patients in the wards of the hospital.

Statistical analysis was performed using Microsoft Excel® 2021. Descriptive statistics, including mean and standard deviation, were used to describe continuous variables while frequency statistics, such as number and percentage, were used to describe categorical variables.

Results

Demographic Analysis: The study enrolled total 600 patients from the Medicine, Surgery, and Obstetrics & Gynecology wards based on inclusion criteria. The demographic analysis showed a mean age of 40.54 years, with females representing 52% of the population. Male-to-female ratio was 0.9:1. Highest number of patients (291) were enrolled from the Medicine Department. Most patients had Neurological, hepatobiliary, renal, and respiratory disorders in this department, while the Surgery department frequently dealt with abscesses, trauma, and acute pancreatitis. Primigravida and full-term delivery cases were the most common from Obstetrics & Gynecology Department. **(Table 1).**

Table 1: Age & Gender wise distribution of study population (N=600)

Age group (Years)	Male	Female	Total (%)
18-29	71(11.83%)	144 (24%)	215 (35.83%)
30-44	76(12.67%)	68(11.33%)	144 (24%)
45-64	104(17.33%)	64(10.67%)	168 (28%)
≥65	39(6.5%)	34(5.67%)	73 (12.17%)
Total	290	310	600

Prajapati D, et al., J Pharm Pharmacol Res 2025
DOI:10.26502/fjppr.0107

Evaluation of prescribed antibiotics:

Overall: A total of 983 antibiotics were prescribed on the second day, with the Medicine department accounting for the highest percentage (45.88%). As shown in **Table 2,** average number of antibiotics per patient was 1.55 in Medicine, 1.58 in Surgery, and 1.89 in Obstetrics & Gynecology. The most prescribed antibiotics were Ceftriaxone (Watch group), Metronidazole (Access group), and Piperacillin + Tazobactam (Watch group). Intravenous administration was the most preferred route in hospitalised patients in Medicine and Surgery wards, while oral administration predominated in Obstetrics & Gynecology.

Medicine: Evaluation of Prescribed antibiotics in Medicine wards is shown in Table-3. 451 antibiotics were prescribed on the 2nd day, decreasing to 434 on the 7th day . Ceftriaxone (Watch group) was the most frequently prescribed antibiotic, accounting for 41.91% on the 2nd day and 38.25% on the 7th day. Metronidazole (Access group) was the second most common, followed by Piperacillin+tazobactam (Watch group). Cephalosporins representing 46.34% of total prescriptions, followed by beta-lactam/beta-lactamase inhibitors (13.97%) and Nitroimidazoles (12.86%).

Surgery :301 antibiotics were prescribed on the 2nd day, reducing to 291 on the 7th day. As shown in

Table 2: Analysis of total antibiotics prescribed on second day (N= 983)

No. of prescribed antibiotics	Medicine (n=291 patients)	Surgery (n=187 patients)	Obstetrics & gynecology (n=122 patients)
Total antibiotics n=983 (%)	451 (45.88%)	301 (30.62%)	231 (23.50%)
Average no. of antibiotics per patient, (Mean ± SD)	1.55± 0.72	1.58± 0.58	1.89±1.27
No. of antibiotic prescribed per patient			
1	57.04%	46.53%	63.93%
2	32.65%	48.66%	4.92%
>3	10.31%	4.81%	31.15%

Table 3: Analysis of antibiotics prescribed in Medicine wards

Class	AWaRe category	Antibiotics (ATC code)	Dose	2nd Day n=451 (%)	7th Day n=434 (%)
Cephalosporin	Watch	Ceftriaxone (J01DD04)	1 gm, 2 gm	41.91	38.25
Nitroimidazole	Access	Metronidazole (J01XD01)	500 mg	12.86	13.82
Beta lactam/beta-lactamase inhibitor	Watch	Piperacillin+ tazobactam (J01CR05)	2.25 gm, 4.5 gm	10.64	12.21
Macrolide	Watch	Azithromycin (J01FA10)	500 mg	9.09	6.68
Fluoroquinolone	Watch	Levofloxacin (J01MA12)	500 mg,750 mg	2	2.76
Rifamycin	Watch	Rifaximin (A07AA11)	550 mg	5.32	5.53
Beta lactam/beta-lactamase inhibitor	Not recommended	Cefoperazone + sulbactam (J01CR04)	1.5 gm	1.77	2.07
Lincosamide	Access	Clindamycin (J01FF01)	600 mg	1.11	1.61
Glycopeptide	Watch	Vancomycin (A07AA09)	500 mg, 1 gm	3.77	3.46
Carbapenem	Watch	Meropenem (J01DH02)	500 mg, 1 gm	0.89	1.84
Oxazolidinones	Reserve	Linezolid (J01XX08)	600 mg	0.67	0.69
Fluoroquinolone	Watch	Ciprofloxacin (J01MA02)	500 mg	2	2.07
Sulfonamide	Access	sulfamethoxazole+trimethoprim (J01EC01)	480 mg	0.22	1.38
Beta lactam/beta-lactamase inhibitor	Access	Amoxicillin+ clavulanic acid (J01CR02)	625 gm,1.2 gm	1.55	1.15
Nitrofurantoin	Access	Nitrofurantoin (J01XE01)	100 mg	1.33	1.38
Cephalosporin	Watch	Cefotaxime (J01DD01)	1 gm	3.77	3.92
Cephalosporin	Watch	Cefixime (J01DD08)	200 mg	0.22	0.46
Tetracycline	Access	Doxycycline (J01AA02)	100 mg	0.44	0.23
Cephalosporin	Watch	Ceftazidime (J01DD02)	1 gm	0.44	0.46

Citation: Dr Damini Prajapati, Shah Megha H, Desai Chetna K. Evaluation of Antibiotics Prescribing Patterns at a Tertiary Care Teaching Hospital Using WHO AWaRe Classification. Journal of Pharmacy and Pharmacology Research. 8 (2025): 36-44.

Prajapati D, et al., J Pharm Pharmacol Res 2025
DOI:10.26502/fjppr.0107

Table- 4, Metronidazole was the most commonly prescribed antibiotic (32.89% on day 2 and 32.65% on day 7). Cefoperazone+sulbactam (Not Recommended) and amoxicillin+clavulanic acid were also frequently prescribed. Beta-lactam/beta-lactamase inhibitors were the most prescribed antibiotic class (34.22%), followed by Nitroimidazoles (32.89%) and Cephalosporins (13.29%).

Obstetrics & Gynecology wards: 231 patients were analysed on the 2nd day. Cefixime (Watch group) was the most frequently prescribed antibiotic (30.74%), followed by metronidazole (18.61%) and ceftriaxone (18.18%). Cephalosporins accounted for 51.52% of prescriptions, followed by nitroimidazoles (18.61%) and aminoglycosides (16.45%) **(Table 5).** Data collection on the seventh day was not feasible for most patients due to early discharge of patients.

Prescription pattern of antibiotics according to AWaRe classification:

In the study, a total of 983 antibiotics prescribed to 600 patients. In terms of AWaRe classification, 31.64% of antibiotics were from the Access group, 59.82% from the Watch group, 1.93% from the Reserve group, and 6.51% from the Not Recommended group. The most prescribed Access antibiotic was metronidazole (20.35%), followed by amoxicillin + clavulanic acid (4.37%). Ceftriaxone was the most frequently prescribed Watch group antibiotic (24.42%), followed by cefixime (7.63%). Linezolid was the most commonly used Reserve antibiotic, while cefoperazone + sulbactam was most common belong to Not Recommended group. **(Table 6)**

Table 4: Analysis of antibiotics prescribed in Surgery wards

Drug Class	AWaRe category	Antibiotic (ATC code)	Dose	2nd Day n=301 (%)	7th Day n=291 (%)
Nitroimidazole	Access	Metronidazole (J01XD01)	500 mg	32.89	32.65
Beta lactam/beta-lactamase inhibitor	Not recommended	Cefoperazone + sulbactam (J01CR04))	1.5 gm	18.27	20.27
Beta-lactam/Beta-lactamase inhibitor	Access	Amoxicillin+ clavulanic acid (J01CR02)	625 gm,1.2 gm	11.96	12.03
Cephalosporin	Watch	Cefotaxime (J01DD01)	1 gm	9.3	7.22
oxazolidinones	Reserve	Linezolid (J01XX08)	600 mg	5.32	4.47
Fluoroquinolone	Watch	Levofloxacin (J01MA12)	500 mg,750 mg	4.32	3.09
Beta-lactam/Beta-lactamase inhibitor	Watch	Piperacillin+ tazobactam (J01CR05)	2.25 gm, 4.5 gm	3.65	4.81
Fluoroquinolone	Watch	Ciprofloxacin (J01MA02)	500 mg	3.65	3.44
Carbapenem	Watch	Meropenem (J01DH02)	500 mg, 1 gm	3.32	4.12
Cephalosporin	Watch	Ceftriaxone (J01DD04)	1 gm, 2 gm	2.99	3.09
Lincosamide	Access	Clindamycin (J01FF01)	600 mg	1.33	1.37
Cephalosporin	Watch	Cefixime (J01DD08)	200 mg	1	1.03
Tetracycline	Access	Doxycycline (J01AA02)	100 mg	0.66	0.69
Aminoglycoside	Access	Amikacin (J01GB06)	500 mg	0.66	1.37
Rifamycin	Watch	Rifaximin (A07AA11)	550 mg	0.33	0.34
Penicillin	Access	Benzathine penicillin (J01CE08)	2.4 mU	0.33	0

Table 5: Analysis of antibiotics prescribed in Obstetrics& Gynecology wards (N=231)

Drug Class	AWaRe category	Antibiotic (ATC code)	Dose	2nd Day n=231 (%)
Cephalosporin	Watch	Cefixime (J01DD08)	200 mg	30.74
Nitroimidazole	Access	Metronidazole (J01XD01)	500 mg	18.61
Cephalosporin	Watch	Ceftriaxone (J01DD04)	1 gm, 2 gm	18.18
Fluoroquinolone	Watch	Levofloxacin (J01MA12)	500 mg,750 mg	12.12
Aminoglycoside	Access	Amikacin (J01GB06)	500 mg	10.39
	Access	Gentamicin (J01GB03)	80 mg	6.06
Cephalosporin	Access	Cefadroxil (J01DB05)	500 mg	2.6
Beta-lactam/beta-lactamase inhibitor	Not recommended	Cefoperazone + sulbactam (J01CR04))	1.5 gm	0.87
Tetracycline	Access	Doxycycline (J01AA02)	100 mg	0.43

Citation: Dr Damini Prajapati, Shah Megha H, Desai Chetna K. Evaluation of Antibiotics Prescribing Patterns at a Tertiary Care Teaching Hospital Using WHO AWaRe Classification. Journal of Pharmacy and Pharmacology Research. 8 (2025): 36-44.

Prajapati D, et al., J Pharm Pharmacol Res 2025
DOI:10.26502/fjppr.0107

Table 6: Pattern of antibiotics use according to WHO Aware classification (N=983)

Access group antibiotics	n=311 (31.64%)	Watch group Antibiotic (ATC code)	n=588 (59.82%)	Reserve group antibiotics n=19 (1.93%)	Not recommended group antibiotics n=65 (6.51%)
Metronidazole (J01XD01)	200 (20.35)	Ceftriaxone (J01DD04)	240 (24.42)	Linezolid (J01XX08)	Cefoperazone+sulbactam (J01CR04)
Amoxicillin + clavulanic acid (J01CR02)	43 (4.37)	Cefixime (J01DD08)	75 (7.63)		
Amikacin (J01GB06)	26 (2.64)	Piperacillin tazobactam (J01CR05)	59 (6)		
Gentamicin (J01GB03)	14 (1.42)	Levofloxacin (J01MA12)	50 (5.09)		
Clindamycin (J01FF01)	9 (0.92)	Cefotaxime (J01DD01)	45 (4.58)		
Nitrofurantoin (J01XE01)	6 (0.61)	Azithromycin (J01FA10)	41 (4.17)	Access to watch ratio: 0.5	
Cefadroxil (J01DB05)	6 (0.61)	Rifaximin (A07AA11)	25 (2.54)		
Doxycycline (J01AA02)	5 (0.51)	Ciprofloxacin (J01MA02)	20 (2.03)		
sulfamethoxazole + Trimethoprim (J01EC01)	1 (0.10)	Vancomycin (A07AA09)	17 (1.73)		
Benzathine penicillin	1 (0.10)	Meropenem (J01DH02)	14 (1.42)		
		Ceftazidime (J01DD02)	2 (0.20)		

Medicine wards: Watch antibiotics belong to most prescriptions (80.04% on the 2nd day, decreasing to 77.65% by the 7th day), while Access antibiotics accounted for 17.52% and increased to 19.59% by day 7. Reserve antibiotics constituted a minimal portion of prescriptions, with 0.67% on the 2nd day and 0.69% on the 7th. The Access to Watch ratio in Medicine Department was 0.2 on the 2nd day and 0.3 on the 7th day. **(Figure-1)**

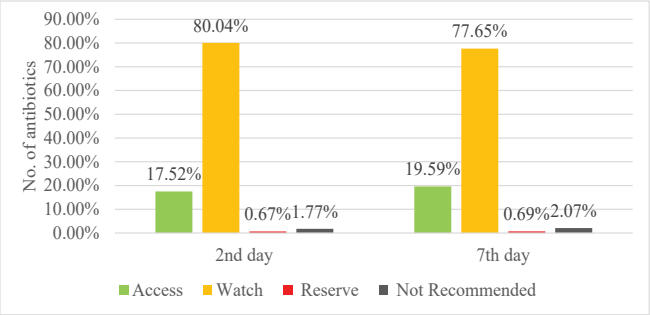


Figure 1: Prescription of antibiotics according to AWaRe classification in Medicine wards on 2nd day (n=451) & on 7th day (n=434)

Surgery wards: Access antibiotics comprised 47.84% of prescriptions on the 2nd day, increasing to 48.11% on the 7th day. Watch antibiotics represented 28.57% on the 2nd day and 27.15% on the 7th day. The Reserve and Not Recommended antibiotics showed similar levels on both days, with the Not Recommended group increasing from 18.27% to 20.27% on the 7th day. The Access to Watch ratio was 1.7 on the 2nd day and 1.8 on the 7th day respectively. **(Figure-2)**

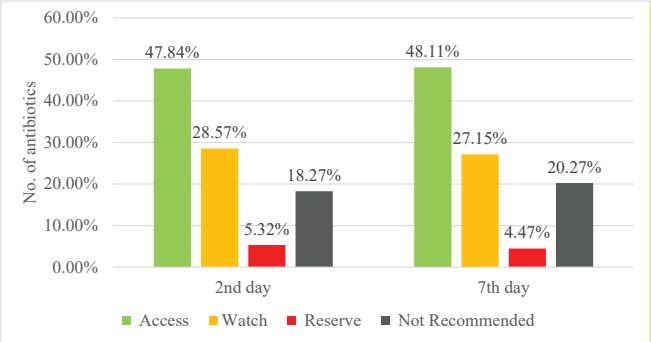


Figure 2: Prescription pattern of antibiotics according to AWaRe classification in Surgery wards on 2nd day(n=301) & on 7th day (n=291)

Obstetrics and Gynecology: Watch group of antibiotics were the majority, accounting for 61.04% of prescriptions, followed by Access antibiotics (38.09%)'. No antibiotics from Reserve group had been prescribed. The Access to Watch ratio was 0.6 on the 2nd day. Overall, the study revealed a high reliance on Watch antibiotics, particularly in the Medicine and Obstetrics & Gynecology department. **(Figure-3)**

Figure-4 depicts patterns of antibiotic prescribing according to gender and age. For male patients 33.69% of prescribed antibiotics belong to Access group, 52.70% from the Watch group while 29.81% of antibiotics from the Access group, 66.15% from the Watch group for female patients. For those aged 65 years and above, 30.91% of antibiotics were from the Access group and 60.00% from the Watch group.

Prajapati D, et al., J Pharm Pharmacol Res 2025
DOI:10.26502/fjppr.0107

Prescribed antibiotics as prophylactically or on basis of culture sensitivity report:

Out of a total of 600 patients, antibiotics were prescribed for prophylaxis in 56.67% of cases. Among these, 154 cases (25.67%) were for surgical prophylaxis, and 186 cases (31.00%) for medical prophylaxis. Additionally, antibiotics were prescribed as empirical treatment in 252 cases (42.00%) and based on culture sensitivity testing in 8 cases (1.33%). Changes in antibiotics occurred between day 2 and day 7, particularly in cases where patient conditions worsened or infections were resistant to initial treatments. Concomitant drugs were frequently prescribed, with an average of 4.78 drugs per patient. Proton Pump Inhibitors (PPIs) were the most common, followed by antiemetics, vitamins, and intravenous fluids.

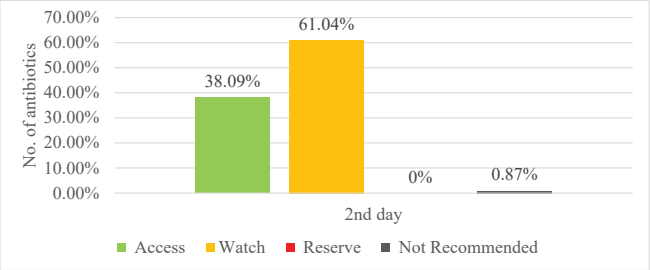


Figure 3: Prescription pattern of antibiotics according to AWaRe classification in Obstetrics and Gynecology wards on 2nd day (n=231)

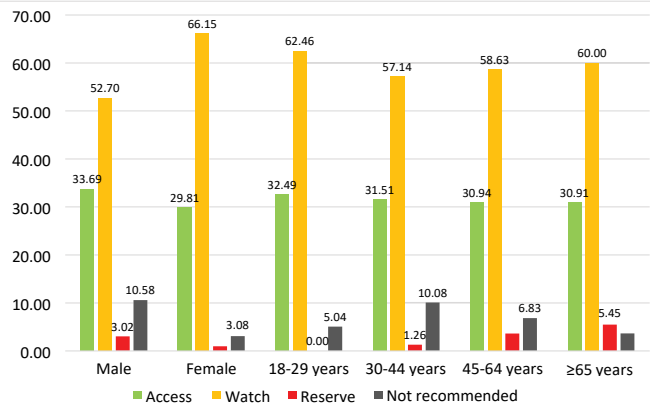
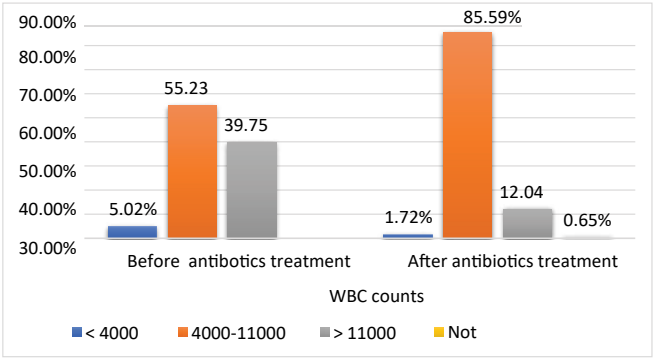


Figure 4: Gender & age wise analysis of antibiotics according to WHO AWaRe

Evaluation of WBC Count:

The figure 5 illustrates an analysis of white blood cell (WBC) counts before and after antibiotic treatment. After antibiotic treatment, the number of patients with WBC counts less than 4000 µl decreased , while those in the normal range increased.

Figure 5: Analysis of change in WBC count before & after antibiotics treatment



*Before antibiotics treatment number of patients n=478
*After antibiotics treatment number of patients n=465 and 10 patients discharged

Evaluation of change in prescribed antibiotic therapy:

A few cases showed changes in prescribed antibiotics between day 2 and day 7. These changes included an increase in the number of antibiotics, a shift in the AWaRe category, or a switch to different antibiotics within the same AWaRe category.

Selected indicators for investigating antimicrobials use in hospitals

The prescribing indicators show an average of 1.55,1.58 and 1.89 antibiotics prescribed per hospitalization in Medicine, Surgery and Obstetrics & Gynecology Department. (Table-7) The antibiotics prescribed by brand name include piperacillin+ tazobactam, rifamycin, linezolid, sulfamethoxazole and trimethoprim, and amoxicillin+clavulanic acid. Out of 600 patients, 594 (99 %) patients received antibiotics from the hospital supply, while 6 (1%) patients received their antibiotic from private pharmacies, which was nitrofurantoin.

Table 7: Analysis of selected indicators for investigating antimicrobials use in hospitals

Sr.No	Name of the indicator	Result
1	Average number of antibiotics prescribed Medicine, Surgery and Obstetrics and Gynecology wards	1.55, 1.58, 1.89
2	Percentage of antibiotics prescribed by generic name in Medicine, Surgery and Obstetrics and Gynecology wards on 2nd day	81.60%, 78.74%, 100%
	Percentage of antibiotics prescribed by generic name in medicine and surgery wards on 7th day	79.03%, 78.35%
3	Existence of approved hospital formulary list or essential medicines list	Yes

Citation: Dr Damini Prajapati, Shah Megha H, Desai Chetna K. Evaluation of Antibiotics Prescribing Patterns at a Tertiary Care Teaching Hospital Using WHO AWaRe Classification. Journal of Pharmacy and Pharmacology Research. 8 (2025): 36-44.

Prajapati D, et al., J Pharm Pharmacol Res 2025
DOI:10.26502/fjppr.0107

Discussion

The present study found a mean age of 40.54±17.19 years, with 60% of patients under 44 years, which is comparable to the findings from a similar study conducted in Ethiopia by Demoz et al [5] in the year 2019, who reported a mean age of 43.97 years. In contrast, a point prevalence survey of antibiotic consumption in a tertiary care hospital of central India reported 58.9% of patients in the 18-40 age group [**6**]. We observed that the average number of antibiotics prescribed per patient was 1.55 in Medicine, 1.58 in Surgery, and 1.89 in Obstetrics & Gynecology. These results are comparable to Demoz et al [5] findings in Medicine (1.57) but lower in Surgery (2.54). A higher average was observed in Obstetrics & Gynecology compared to Demoz et al. (1.53). In Obstetrics & Gynecology, 63.93% of patients were prescribed a single antibiotic, which is higher as compared to 30% reported by Makiabadi et al. [7] indicating a preference for monotherapy in this department. Cephalosporin was the most prescribed antibiotic group in our Medicine wards, constituting 46.34%, with ceftriaxone accounted for 41.91%, consistent with Dereje et al. [8] (35.70%) and Kumari et al. [9] (35.6%). Metronidazole was the second most prescribed antibiotic (12.86%) in both studies. Metronidazole was the most common antibiotic (32.89%) in Surgery wards, which was lower than 52% reported by Priestly Vivekkumar et al. [10]. Cefosulbactam was prescribed to 18.27% of patients, aligning (17.5%) with results from Sajan et al [11]. In Obstetrics & Gynecology, Cephalosporins accounted for 51.52% of antibiotics, comparable to (50.68%), a drug utilisation study done by Makiabadi and colleagues [7] in Department of Obstetrics and Gynecology at tertiary care hospital in India. Metronidazole was used in 18.61% of cases in present study in contrast to 31.05%.in above mentioned study [7]. The analysis of WBC counts before and after antibiotic treatment in the Medicine and Surgery Departments shows notable improvements. Following treatment, number of patients with with normal WBC counts increased from 55.23% to 85.59%, reflecting effective antibiotic use. In this study, antibiotic use was categorized into WHO AWaRe classification, with 31.64% of prescribed antibiotics belong to the Access category, 59.82% to Watch, and 1.93% to Reserve category. This resulted in an Access-to-Watch ratio of 0.5, which is lower than the WHO recommended ratio of 1.5. Comparatively, the Global Point Prevalence Survey (Global-PPS) [12] for lower-middle-income countries reported similar trends, with 33.50% Access, 63.40% Watch, and 1.40% Reserve antibiotics. In contrast, a study in Zambia [13] reported a higher use of Access antibiotics (55.50%) and fewer Watch antibiotics (43.10%), suggesting that outpatient care, where Access antibiotics are more commonly used, influenced the difference.

Our study revealed that very few (6.51%) prescribed antibiotics were belong to "Not Recommended" category, similar to the 5.70% reported in medical wards by Hodoșan et al [14]. The Medicine department in our study showed 80.04% Watch and 17.52% Access antibiotics, while a Tanzanian study [15] reported 60.81% Access and 39.19% Watch, highlighting the difference in reliance on broader-spectrum antibiotics. In Surgery, our study found 47.84% Access, 28.57% Watch, and 5.32% Reserve antibiotics, while the Tanzanian study reported a higher use of Access antibiotics (73.85%). In Obstetrics & Gynecology, 61.04% of antibiotics were from the Watch category, higher than the 15.28% reported by Nsojo et al [15] in Tanzania. The most prescribed antibiotic in our study was ceftriaxone (Watch group, 24.42%), aligning with findings by Purohit et al. (37.2%) and Mudenda et al. [13] (26.6%). Probable reasons for this preference could be availability of medicines, perception of safety or efficacy by the clinicians. Metronidazole, from the Access group, was the second most used antibiotic (20.5%), consistent with findings by another study [13] (22.6%). The use of Cefixime (7.63%) and Cefosulbactam (6.61%) was higher in our study than study by Purohit et al [6] (1.1% and 4.5%, respectively). Piperacillin-tazobactam (6.00%) and Levofloxacin (5.09%) were similar in both studies, with slightly higher use in our setting. Linezolid, a Reserve antibiotic, was prescribed to 1.93% of patients in our study, lower than the 3.8% reported by Purohit et al [6]. The present study revealed a higher reliance on Watch antibiotics across all wards, indicating high patient load and catering critical cases with other concomitant diseases being a tertiary care centre necessitated empirical or prophylactic use of broad-spectrum antibiotics.

The study found that 90.69% of antibiotics prescribed in the Medicine wards were from the National List of Essential Medicines (NLEM), lower than Dereje et al [8] but higher than the 54% reported by Kujur et al [16]. In Obstetrics & Gynecology, 87.01% of antibiotics were from NLEM, similar to 85.80 % by Sachdev et al [17] Adherence to the State Essential Medicines List (EML) was high across departments, with 100% adherence in Surgery and Obstetrics & Gynecology and 98.67% in Medicine. It was also observed in our study that antibiotics were prescribed in 56.67% cases for prophylaxis, closely matching to 57.8% by an Indian study [6], while empirical use was noted in 42% cased, higher as compared to 31.60%. Only in 1.33% of cases antibiotics were prescribed based on culture sensitivity reports in our hospital, compared to 10.6% in another study, indicating underutilization of microbiology services. As many of critically ill patients visit the hospital as largest Tertiary care Government hospital in district therefore keeping in view of saving life of patients clinicians prescribed antibiotics for large number of cases. Regarding generic prescribing, the Medicine wards had a high rate of 81.60%, higher than Dereje et al. (75.74%). In Obstetrics & Gynecology, 100% of antibiotics were prescribed by generic name, higher than

Prajapati D, et al., J Pharm Pharmacol Res 2025
DOI:10.26502/fjppr.0107

the 74.9% reported by Sachdev et al [17]. According to the WHO indicators, prescribing antibiotics by their generic name is one of the straightforward indicators of using low-cost antibiotics. This indicates good practice of adherence to generic prescribing in our setting and should be encouraged. For concomitant drugs, Proton Pump Inhibitors (PPIs) were prescribed in 94.67% of cases, higher compared to 29.40%. reported by Mittal et al. [18] Antiemetics were used in 68.83% of cases in our study, also higher than Mittal et al.

Limitations of the study is exclusion of pediatric patients and other specialties. Also, we have not observed outcome of the patients and any adverse drug reactions due to antibiotics as patients were observed only on 2nd and 7th day of antibiotic therapy. However, we have analysed good number of cases catering three major wards of a tertiary care government hospital and also evaluated selected indicators for investigating antimicrobials use in hospitals. As of per our literature search, no study has been conducted before evaluating antimicrobial use as per WHO AWaRe tool in our hospital and findings from the study could serve as a guide for developing Antimicrobial Stewardship Program.

The study emphasized the need for robust Antimicrobial Stewardship Programs (ASP) to improve use of Access group antibiotics, as well as restrict the use of Watch and Reserve antibiotics. Moreover, the development of hospital specific Standard Treatment Guidelines (STGs) for infectious diseases with complications or other comorbidities to curb irrational antibiotic prescribing is required. Studies with longer follow-up catering patients across different departments were recommended to assess the long-term outcomes of antibiotic use.

Acknowledgements: Authors are thankful to Dr. K J Upadhyay, HOD, Medicine, Dr R R Patel, HOD, Surgery and Dr. A U Mehta, HOD, Gynecology for their guidance and support.

Conflicts of Interest: Nil

References

1. Taneja N, Samanta P, Mishra A and Sharma M. Emergence of tetracycline resistance in Vibrio cholerae O1 biotype El Tor serotype Ogawa from north India. Indian Journal of Pathology and Microbiology 53 (2010): 865-866
2. World Health Organization. Antimicrobial resistance: Key facts (2019a).
3. Mugada V, Mahato V, Andhavaram D and Vajhala SM. Evaluation of prescribing patterns of antibiotics using selected indicators for antimicrobial use in hospitals and the access, watch, reserve (AWaRe) classification by the World Health Organization. Turkish journal of pharmaceutical sciences 18 (2021): 282.
4. World Health Organization. AWaRe classification (2021).
5. Demoz GT, Kasahun GG, Hagazy K, Woldu G, Wahdey S, et al. Prescribing pattern of antibiotics using WHO prescribing indicators among inpatients in Ethiopia: a need for antibiotic stewardship program. Infection and Drug Resistance 30 (2020): 2783-2794.
6. Purohit M. Point prevalence survey of antibiotic consumption in a tertiary care hospital of central India.
7. Makiabadi F, Rajeswari R. and Jayashree AK. Prescribing pattern of drugs in department of obstetrics and gynecology at a tertiary care teaching hospital, Bangalore, India. Hypertension 18 (2021): 24-65
8. Dereje B, Hailu D and Megersa A. Prescribing pattern of antimicrobials in the internal medicine ward at Hawassa University Comprehensive Specialized Hospital, Hawassa, Ethiopia: A Retrospective study. Harla Journal of Health and Medical Science 1 (2022): 13-30
9. Kumari S, Bagati KD and Krishnan SB. Study of antibiotic utilization pattern in tertiary care teaching hospital. National Journal of Physiology, Pharmacy and Pharmacology 11 (2021): 622-627.
10. S Priestly Vivekkumar, A Aswin, Balaji Arumugam, D Jeyakumari, et al. Antimicrobial drugs usage in a tertiary care hospital –A descriptive study. IJPR 5 (2015): 231-35.
11. Sajan K, RBS, GGM and JL. Drug Utilization Pattern of Antibiotics in Surgery Department in a Tertiary Care Hospital. International Journal of Research in Engineering, Science and Management 1 (2018): 2–8.
12. Global Point Prevalence Survey. World Health Organization. Global Antimicrobial Resistance Surveillance System (2020c).
13. Mudenda S, Nsofu E, Chisha P, Daka V, Chabalenge B, et al. Prescribing patterns of antibiotics according to the WHO AWaRe classification during the COVID-19 pandemic at a teaching hospital in Lusaka, Zambia: implications for strengthening of antimicrobial stewardship programmes. Pharmacoepidemiology 2 (2023): 42-53.
14. Hodoșan V, Daina LG, Zaha DC, Cotrău P, Vladu A, et al. Pattern of antibiotic use among hospitalized patients at a level one multidisciplinary care hospital. In Healthcare 11 (2023): 1302.
15. Nsojo A, George L, Mwasomola D, Tawete J, Mbotwa CH, et al. Prescribing patterns of antimicrobials according to the WHO AWaRe classification at a tertiary referral hospital in the southern highlands of Tanzania. Infection Prevention in Practice 6 (2024): 100347
16. Kujur ADS, Ekka NMP and Chandra S. Antibiotic

Prajapati D, et al., J Pharm Pharmacol Res 2025
DOI:10.26502/fjppr.0107

utilization pattern in the department of surgery in a tertiary care centre in eastern India. International Surgery Journal 6 (2019): 4080-4085.

17. Sachdev D, Salwe KJ, Dev A, Singha B and Ambing H. Prescription audit using the World Health Organization prescribing indicators for indoor patients treated under CMAAY/PMJAY insurance schemes in a tertiary care teaching hospital. Asian Journal of Pharmaceutical and Clinical Research 15 (2022): 51-56

18. Mittal N, Mittal R, Singh I, Shafiq N and Malhotra S. Drug utilisation study in a tertiary care center: Recommendations for improving hospital drug dispensing policies. Indian journal of pharmaceutical sciences 76 (2014): 308.