

Practice of Antibiotic Use Based on WHO AWaRe Classification Framework at Tertiary Care Center of Nepal: An Observational Study

Naresh Karki,^{1,*} Bijay Bhandari¹, Pravin Prasad², Jeevan Khanal³, Raju Prasad Shakya⁴

ABSTRACT:

Introduction: The WHO AWaRe (Access, Watch, Reserve) classification is an important tool for monitoring antibiotic stewardship and curbing antibiotic resistance. This study described the prevalence of antibiotic use based on WHO AWaRe classification at a tertiary care center. **Methods:** A cross-sectional study was conducted in internal medicine department from 24 December 2025 to 23 March 2026 for a duration of three months after approval from Institutional Review Committee, Protocol No: 16/25/V1.R0. Patients who were prescribed at least one antibiotic in outpatient prescription forms or inpatient medication charts were included. Convenience sampling method was used. Data of patients, including socio-demographic profile, clinical characteristics, and antibiotic use patterns, were collected. The WHO AWaRe classification was used to assess patterns of antibiotic use. Data were expressed as mean and standard deviation, frequency and percentage using PSPP 2.1.1. **Results:** Of the total 218 patients, 139 (63.76%) were female. A total of 410 antibiotics were used. Average number of antibiotics prescribed per patient was 1.88 ± 0.90 . From watch group, 292 (71.21%) antibiotics were used. Of the total antibiotics used from watch group, 238 (58.04%) were prescribed to those above 50 years of age, and 166 (40.46%) to females. Moreover, 363 (88.53%) antibiotics were prescribed from National List of Essential Medicines Nepal 2021 (Sixth Revision). **Conclusions:** Majority of drugs used belonged to watch group of the WHO AWaRe classification. The study suggests a coordinated effort for antibiotic stewardship and scope for improvement of antibiotic use from access group.

Keywords: Antibiotic; AWaRe; Tertiary care center; WHO.

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¹Department of Pharmacology, Lumbini Medical College & Teaching Hospital, Palpa, Nepal

²Department of Pharmacology, Institute of Medicine (TU), Maharajgunj, Kathmandu, Nepal

³Department of Internal Medicine, Lumbini Medical College & Teaching Hospital, Palpa, Nepal

⁴Department of Emergency Medicine, Lumbini Medical College & Teaching Hospital, Palpa, Nepal

*Corresponding Author:

Naresh Karki

Email: karki007naresh@gmail.com

ORCID: [0000-0002-8788-6443](https://orcid.org/0000-0002-8788-6443)

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INTRODUCTION:

Antibiotic resistance is an alarming global public health problem that can lead to an increase in morbidity, mortality, and healthcare costs in low-and middle-income countries like Nepal.^{1,2} Besides, the irrational use of antibiotics, such as unnecessary use in viral infections, and their incomplete courses, also fuels the emergence and dissemination of antibiotic resistance.^{2,3}

In 2017, the WHO developed the AWaRe (Access, Watch, Reserve) classification framework of antibiotics as a tool to support antibiotic stewardship programs globally.^{4,6} This classification categorizes into four groups: Access, Watch, Reserve, and Not Recommended, broadly based on the potential of antibiotics to develop antibiotic resistance and their cost-effectiveness.^{4,7} In Nepal, data on antibiotic use are rarely reported, and only limited studies exist on drug use patterns based on AWaRe classification.^{8,9} Therefore, the assessment of antibiotics used based on the WHO AWaRe classification is useful in hospitals for optimizing the quantitative and qualitative use of antibiotics, curbing antibiotic resistance, and prescribing antibiotics rationally.⁵⁻⁷

Thus, this study aims to describe the practice of antibiotic use based on the WHO AWaRe classification at the tertiary care center.

METHODS:

A hospital-based observational, descriptive, and cross-sectional study was carried out in the outpatient (OPD) and inpatient departments of internal medicine at Lumbini Medical College and Teaching Hospital (LMCTH), Tansen, Palpa, Nepal, from 24 December, 2025 to 23 March, 2026 for the duration of three months. The study was ethically approved by the Institutional Review Committee of Lumbini Medical College and Teaching Hospital with Protocol No: 16/25/V1.R0. Similarly, the approval letter was also obtained from the internal medicine department of the institute.

The patients who were prescribed at least one antibiotic in prescription forms or inpatient medication charts, irrespective of age, gender, and diagnosis, were included in the study. Similarly, the systemic antibiotics under the J01 category of the WHO Anatomical Therapeutic Chemical (ATC) classification prescribed by the doctors were included in the study. This category contains antibiotics used for systemic infections, with the exclusion of antimycobacterial and topical antibiotics.¹⁰ Also, the parenteral metronidazole, which is used for the treatment of anaerobic bacterial infections and labelled under the J01 category, was accounted for in the study. At the same time, those prescriptions with incomplete information were excluded. Likewise, prescriptions with nitroimidazoles used for protozoal infections were also excluded.

Sampling was drawn by the non-probability convenience method. The sample size was estimated using the single-proportion formula, $n = Z^2p(1-p)/d^2$. Where 'n' is the sample size, 'Z' is 95% of the confidence level (1.96), 'p' is the prevalence of antibiotic use in the population based on another study (42.8%),^{11,12} 'd' is the margin of error = 8%. Hence, the sample size calculated was 147. To compensate for potential non-response, incomplete questionnaires, or data entry errors, an additional 10% of the data was included in the study. Thus, the calculated minimum sample size was 162.

The WHO AWaRe classification framework was used to assess patterns of antibiotic use.¹³ Moreover, the evaluation of the use of antibiotics from the essential drug list was done by reviewing the National List of Essential Medicines Nepal 2021 (Sixth Revision).¹⁴

Further, the information related to socio-demographic profile (age, gender, ethnicity), clinical characteristics (diagnosis, comorbidity), and antibiotic use practice (class of antibiotic, name of antibiotic, use of antibiotics from AWaRe classification and essential drug list) was collected and recorded into the proforma designed for the same. The common outcome measures were the most commonly prescribed antibiotic, the average number of antibiotics per patient, the distribution of antibiotics ac-

cording to the AWaRe classification framework, and the availability of antibiotics according to the national list of essential medicines of Nepal. Patient confidentiality was ensured by de-identifying the data and securing it with password-protected software. The Institutional Review Committee waived the requirement of informed consent as the data were collected from de-identified medical records.

The collected data were entered into the PSPP 2.1.1 software. Continuous variables were expressed as mean and standard deviation (SD), whereas categorical variables were reported as frequencies and percentages. The results were presented using tables. The independent t-test and chi-square test were appropriately used for inferential statistics. A p-value less than 0.05 was considered statistically significant.

RESULTS:

A total of 218 patients were included in the study. Of them, 143 (65.60%) were above 50 years of age. There were 139 (63.76%) female and 79 (36.24%) male. The mean age $\pm$ SD of the total patients was 59.70 $\pm$ 19.87 years. Similarly, the mean age $\pm$ SD of female and male patients were 58.16 $\pm$ 19.19 years and 62.42 $\pm$ 20.85 years, respectively ($t[N=218, df=166.13]=-0.65, p=0.52$). Of the total patients, 109 (50.00%) were from the outpatient department and 109 (50.00%) from the inpatient department. Moreover, 136 (62.40%) patients had comorbid diseases. Among the patients suffering from comorbid diseases, 49 (22.47%) had hypertension, followed by diabetes mellitus in 36 (16.51%) patients. In 131 (60.10%) patients, more than one antibiotic was used whereas in the remaining 87 (39.90%), a single antibiotic was used.

A total of 410 antibiotics were used in 218 patients. The average number of antibiotics prescribed per patient was 1.88 $\pm$ 0.90. According to the WHO AWaRe classification, 292 (71.21%) antibiotics were used from the watch group, followed by 111 (27.07%) from the access group, seven (1.72%) from the reserve group, and none from 'not recommended' group. Of the total number of antibiotics used from the watch group, 238 (58.04%) were prescribed to patients above 50 years of age, and 166 (40.46%) to females (**Table 1**).

Table 1. Age group-wise and gender-wise frequency and percentage of antibiotics from different WHO AWaRE groups (N=410)

Variables		Access	Watch	Reserve	Total
Age group (In years)	≤ 50	57 (13.90)	54 (13.17)	3 (0.74%)	114 (27.81)
	> 50	54 (13.17)	238 (58.04)	4 (0.98)	296 (72.19)
Gender	Female	73 (17.80)	166 (40.48)	4 (0.98)	243 (59.26)
	Male	38 (9.26)	126 (30.74)	3 (0.74)	167 (40.74)

Among the antibiotics used in the watch group, azithromycin, followed by ceftriaxone, and piperacillin/tazobactam were the most common. Details of antibiotics used in different groups is presented in **Table 2**. Comparison of sociodemographic and clinical variables between inpatients and outpatients is presented in **Table 3**. The patients admitted to the inpatient department were significantly more likely to be prescribed more than one antibiotic than patients who visited the outpatient department. Moreover, 363 (88.53%) antibiotics were prescribed from the National List of Essential Medicines Nepal 2021 (Sixth Revision). Similarly, 279 (68.04%) antibiotics belonged to the main list, and 84 (20.48%) belonged to the complementary list of the essential drug list of Nepal.

DISCUSSION:

This study provides an overview of the prevalence of antibiotic use practices based on the WHO AWaRe classification framework at a tertiary care hospital in Nepal. In addition to promoting the logical and careful use of antibiotics and supporting antibiotic stewardship programs, studies based on the WHO AWaRe classification also highlight other advantages, such as developing guidelines for using antibiotics in clinical institutions at the local level.¹⁵⁻¹⁷ It also helps in comparing the antibiotic use practices between healthcare institutions nationally and internationally.^{18,19}

The study showed that the mean age of the patients was 59 years. One study disagrees with this, where the mean age was 35 years.¹ The contributory factors for frequent use of antibiotics in middle and old age could be the prevalence of chronic diseases such as diabetes, decreased immune defense mechanisms, and healthcare-seeking behaviors. Gender disparities in medical fields and clinical practices have been well-reported. Approximately two-thirds of the patients in our study were female, which was similar to the results of other studies.^{11,15,19} While a few studies observed that the prevalence of males was higher, or males and females were similarly distributed.^{2,9,16,18} The possible reasons for the frequent occurrence of infections and use of antibiotics in females could be anatomical factors such as a short urethra, increased chances of sexually transmitted diseases, and poor hygiene.

This study also found that the average number of drugs prescribed per patient was 1.88 ± 0.90 , and the majority of patients were prescribed more than one antibiotic. Azithromycin was the most commonly prescribed drug, followed by ceftriaxone. These findings were comparable to those of other studies.^{8,11,17,18} Unlike this study, other studies demonstrated that ampicillin/cloxacillin, amoxicillin/clavulanic acid, and ampicillin were the commonly used antibiotics.^{1,6,16} Azithromycin is commonly used for respiratory tract infections such as community-acquired pneumonia,

Table 2: Availability of antibiotics according to the WHO AWaRe classification (N=410)

S.N.	Groups	Name of Antibiotics	N (%)
1	ACCESS	Doxycycline	27 (6.58)
2		Amoxicillin	25 (6.09)
3		Phenoxy-methylpenicillin	20 (4.88)
4		Amoxicillin / Clavulanic Acid	17 (4.14)
5		Metronidazole	8 (1.95)
6		Nitrofurantoin	7 (1.70)
7		Sulfamethoxazole / Trimethoprim	3 (0.74)
8		Clindamycin	3 (0.74)
9		Ampicillin	1 (0.24)
		Total	111 (27.07)
10	WATCH	Azithromycin	72 (17.56)
11		Ceftriaxone	58 (14.14)
12		Piperacillin / Tazobactam	49 (11.98)
13		Cefixime	29 (7.07)
14		Clarithromycin	23 (5.60)
15		Levofloxacin	20 (4.90)
16		Cefpodoxime	12 (2.92)
17		Ciprofloxacin	10 (2.43)
18		Cefuroxime	7 (1.70)
19		Vancomycin	5 (1.21)
20		Meropenem	3 (0.74)
21		Ofloxacin	1 (0.24)
22		Flucloxacillin	1 (0.24)
23		Norfloxacin	1 (0.24)
24		Cefotaxime	1 (0.24)
		Total	292 (71.21)
25	RESERVE	Imipenem / Cilastatin	4 (0.98)
26		Linezolid	3 (0.74)
		Total	7 (1.72)
	NOT RECOMMENDED	None	0

Table 3: Comparison of sociodemographic/clinical variables between inpatients and outpatient department (N = 218)

Variables	Inpatients	Outpatients	Statistics
Age (in years)	≤50	17	58
	>50	92	51
Presence of Comorbidity	Yes	94	42
	No	15	67
Pattern of antibiotics	One	22	67
	> One	87	42

laryngitis, and pharyngitis. Because the study was conducted during the winter season, when respiratory infections are more prevalent, this may explain the frequent use of azithromycin. Besides, the other reasons could be their broad-spectrum coverage and their use in elderly patients suffering from moderate to severe infections.

Moreover, approximately three-fourths of the antibiotics used in our study belonged to the watch group of the WHO AWaRe classification, which was aligned with the observations of other studies.^{11,16-18} In contrast, some studies highlighted that the majority of antibiotics used were from the access group.^{2,7,19} While one study found a similar distribution of antibiotics in the access and watch groups.¹ One probable reason for the higher consumption of antibiotics from the watch group is that the antibiotics in the access group may not be effective against specific or severe infections, such as severe pneumonia and respiratory tract infections. The lower antibiotic usage in the access group can lead to challenging situations in the healthcare systems of developing countries.¹ The studies revealing higher use of watch group antibiotics indicate a need to review treatment guidelines to improve antibiotic prescribing. Overall, the integration of the AWaRe classification into antibiotic utilization practice and regular antibiotic prescribing audit is useful for enhancing the practice of optimal use of antibiotics and curbing antibiotic resistance.⁷

This study also exhibited that more than three-fourths of the antibiotics used belonged to the National List of Essential Medicines Nepal 2021 (Sixth Revision). Many studies have exhibited similar types of findings where the majority of drugs were prescribed either from the national list of essential drugs or the hospital formulary.^{3,6,7,15,18} The key concept of having the essential drug list for any country is that the highly prioritized drugs must be accessible for the patients to run the healthcare system at all times.¹⁴ However, it is not necessary that doctors should use the drugs from the essential drug list all the time, as many clinical circumstances are not favorable. Some examples are treatment failure with essential drugs, allergic reactions to drugs, a medical condition of the patient that needs alternative drugs, and drug resistance.

The authors are aware of some limitations of the study. The study was conducted only in the medicine department, so the results of it cannot be generalized to other departments. Similarly, the short-duration study could not collect data adequately on antibiotic use for infectious diseases with seasonal variation. Considering the practical constraints, an 8% margin of error was used, which may reduce the precision of the calculation. However, samples were collected more than the minimal sample size because data collection was continued till predetermined end date. The decision to exceed the calculated sample size was not influenced by the observed results. Also, the use of convenience sampling could not be ruled out, as this may have introduced selection bias. Still, the authors hope that this study will provide a valuable description of antibiotic use patterns based on AWaRe classification at a tertiary care center and lay a small foundation for conducting similar studies in the future at multiple departments.

CONCLUSIONS:

The majority of the patients were prescribed more than one antibiotic. Most of the prescribed antibiotics belonged to the watch group of the WHO AWaRe classification framework. Similarly, the majority of the drugs were prescribed from the National List of Essential Medicines Nepal 2021 (Sixth Revision). The study also observes that the pattern of antibiotic use in the hospital was below the WHO criteria of use of 60% of antibiotics from the access group. Thus, the coordinated effort for antibiotic stewardship and the scope for improvement of antibiotic use from the access group in the hospital is suggested.

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Conflict of Interest:

The corresponding author and Dr. Laxmi Prasad Sapkota did not take part in any editorial decision.

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