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Evaluation of Antibiotic Use Patterns at Pharmacy X in Mataram City Using WHO AWaRe Classification

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Abstract

Antimicrobial resistance (AMR) was a major global health threat driven by irrational antibiotic use, including unnecessary prescribing, inappropriate dosage or duration, and use without proper indication. Community pharmacies served as accessible points of care and played an important role in antibiotic distribution, making them strategic settings for evaluating utilization patterns. This study aimed to describe antibiotic utilization in a community pharmacy using the AWaRe classification and to assess the proportion of Access antibiotics relative to World Health Organisation targets. A retrospective observational study was conducted using prescription data from January to June 2025, with purposive sampling and descriptive analysis. A total of 11,565 antibiotic items were recorded. Cefixime (Watch group) was the most frequently used antibiotic (38.2%), followed by amoxicillin (Access group) at 20.9%. The proportion of Access antibiotics was 45.78%, which was below the recommended minimum target of 60%. These findings indicated that antibiotic use was dominated by Watch-group agents, suggesting an imbalance in prescribing patterns and a potential risk for increasing AMR.

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Introduction

Antimicrobial resistance (AMR) occurs when pathogenic microorganisms no longer respond to antimicrobial agents, allowing them to survive and proliferate despite treatment (Muteeb et al., 2023; Nwobodo et al., 2022). The primary drivers of AMR are the excessive and inappropriate use of antimicrobials, particularly antibiotics, which have raised global concerns regarding therapeutic effectiveness (Lukito, 2023; Tang et al., 2023). AMR is recognized as one of the top ten global public

health threats. Bacterial resistance to antibiotics is not only a medical challenge but also a socio-economic burden requiring urgent attention (Cathartica et al., 2025; WHO, 2022). Globally, AMR was responsible for more than 1.2 million deaths in 2019 and is projected to cause up to 10 million deaths annually by 2050 (Abdelsalam Elshenawy et al., 2023; Ding et al., 2023; Tang et al., 2023). In Indonesia, AMR was estimated to contribute to approximately 183,500 deaths in 2021 (IHME, 2024). At the provincial level, data from the National Agency of Drug and Food Control (BPOM) in 2023 indicated that West Nusa Tenggara ranked sixth among provinces with the highest rates of non-prescription antibiotic dispensing, increasing the risk of resistance (BPOM, 2023).

Given the severity of this issue, surveillance and control of rational antibiotic use are essential strategies to prevent AMR. In 2017, the WHO introduced the AWaRe (Access, Watch, Reserve) classification as a global framework to optimize antibiotic prescribing. Indonesia adopted this system in the National Antibiotic Use Guidelines issued by the Ministry of Health in 2021 (Abdelsalam Elshenawy et al., 2023; Kemenkes RI, 2021). The Access group includes first-line antibiotics with a narrow spectrum and low resistance potential; the Watch group consists of antibiotics whose use should be restricted to specific indications due to their high risk of inducing resistance; and the Reserve group comprises last-resort antibiotics for multidrug-resistant infections. The WHO set a global target requiring that at least 60% of a country's antibiotic consumption come from the Access group, increasing to 70% by 2030, to slow the progression of AMR (Kemenkes RI, 2021). Achieving this target is crucial for slowing the spread of resistance and maintaining the long-term effectiveness of antimicrobial therapy.

However, there is a significant discrepancy in antibiotic use data in Indonesia. National sampling-based surveys by BPOM indicate that the proportion of Access antibiotic use has exceeded the target, reaching 66.8%–69.18% (Muteeb et al., 2023). These data suggest an optimistic picture that Indonesia has met the WHO requirements for slowing antibiotic resistance. In contrast, studies conducted in healthcare facilities, particularly hospitals, show different findings. Research at Universitas Indonesia Hospital (RSUI) reported that Watch-group antibiotics were the most commonly used, reaching 86.68% in intensive care units (ICUs) and 85.01% in non-intensive inpatient units (Syafhan et al., 2025). Other hospital-based studies have shown similar patterns, with the Watch group accounting for more than 60% of total antibiotic use (Syafitri & Fiya, 2021).

This discrepancy creates a crucial "evidence gap." National aggregate data may not fully reflect prescribing practices at the clinical level, whereas hospital data may not represent practices in primary care. Community pharmacies, as the frontline of antibiotic dispensing and the intersection between prescriptions from primary care and direct patient access, represent an important yet underexplored sector. Therefore, this study was conducted to address this gap by analyzing AWaRe-based antibiotic use patterns in community pharmacies particularly in high-risk regions such as West Nusa Tenggara to obtain a more accurate picture of real-world practices. Based on this background, the present study aims to describe antibiotic use patterns in community pharmacies in West Nusa Tenggara Province according to the WHO AWaRe classification and to evaluate the proportion of Access antibiotic use relative to the globally recommended targets.

Materials and Methods

Study Design

This study employed a descriptive observational design with a retrospective data collection approach. This design was chosen because it enables the analysis of historical antibiotic utilization patterns from existing records without intervening in ongoing prescribing or dispensing practices, thereby providing an objective picture of real-world conditions.

Study Setting and Duration

The study was conducted at Pharmacy X, a community pharmacy located in the Province of West Nusa Tenggara (NTB). The data analyzed were obtained from prescription archives covering the period from January to June 2025, focusing on prescriptions containing systemic-use antibiotics.

Population and Sample:

The target population in this study comprised all antibiotic prescriptions dispensed at Pharmacy X during the study period. A non-probability purposive sampling technique was employed, in which all prescriptions that met the predefined inclusion criteria were selected as the study sample. The inclusion criteria consisted of prescriptions containing at least one systemic-use antibiotic and with complete, legible information, including the drug name, dosage strength, and quantity dispensed. Prescriptions were excluded if they contained only topical antibiotics (e.g., creams, ointments, or ophthalmic/otic drops); were incomplete or illegible, which could lead to interpretation errors; or had been cancelled by patients and were not dispensed.

The Data for Variables and Operational Definitions

The primary variable in this study was the pattern of antibiotic use, measured through frequency, proportion, and classification according to the AWaRe system. Operational definitions for the AWaRe classification refer to the WHO AWaRe Classification of Antibiotics for Evaluation and Monitoring of Use, 2023 and the National Antibiotic Use Guidelines issued by the Ministry of Health of the Republic of Indonesia in 2021.

Access: Antibiotics recommended as first- and second-line therapy options for common infectious syndromes. This group has a narrower spectrum of activity and lower resistance potential. Examples in this study include amoxicillin, cefadroxil, and ciprofloxacin.

Watch: Antibiotics are recommended for more restricted indications due to their higher potential to induce bacterial resistance. Their use requires close monitoring and represents the main focus of antimicrobial stewardship programs. Examples in this study include Cefixime, levofloxacin, and azithromycin.

Reserve: “Last-resort” antibiotics reserved for the treatment of infections caused by multidrug-resistant (MDR) bacteria. Their use must be highly controlled. Examples in this study include vancomycin and cefepime.

Data Collection Procedures and Types of Data

The data used in this study were secondary data obtained from prescription archives at Pharmacy X from January to June 2025. Data collection involved extracting information on each antibiotic item (generic name and quantity) from prescriptions that met the inclusion criteria. The extracted data were then tabulated in a Microsoft Excel worksheet for further analysis. To maintain confidentiality, all patient-identifying information (such as name and address) and prescriber identity were excluded.

Data Analysis

The data in this study were analyzed quantitatively and presented in percentage tables. Percentage values were calculated using the formula for the ratio between the frequency of a variable (f) and the total number of data points (N), multiplied by 100%. Thus, the percentage (P) for each antibiotic type was obtained and used to classify items within the AWaRe categories. Data processing was performed using Microsoft Excel, and the results were presented in percentage tables to facilitate interpretation.

Results and Discussions

During the study period from January to June 2025, a total of 11,565 systemic antibiotic items were identified from prescriptions that met the inclusion and exclusion criteria. This number served as the basis for all analyses of antibiotic utilization patterns in this study. Distribution analysis showed that among the eight recorded antibiotic types, three accounted for more than 80% of total use. The most frequently used antibiotic was Cefixime, representing 38.2% (4,415 items) of all prescriptions. The second-and third-most commonly used antibiotics were Amoxicillin at 20.9% (2,412 items) and Cefadroxil at 20.8% (2,405 items), respectively. Detailed distributions and classifications for each antibiotic are presented in Table 1. Cefixime is a third-generation cephalosporin with broad-spectrum activity that inhibits bacterial cell wall synthesis by blocking the transpeptidase reaction. It is categorized as a Watch group of antibiotics, reserved for specific infections or used only when Access group antibiotics are no longer effective (Hamadouk et al., 2023).

Table 1
Distribution and AWaRe Classification of Antibiotics Dispensed at Pharmacy X (January–June 2025)

Antibiotic	Quantity Dispensed	Persentage	AWaRe Percentage
Amoxicilin	2412	20.9%	45.78%
Cefadroxcil	2405	20.8%	
Ciprofloxacin	472	4.8%	
Cefixime	4415	38.2%	54.2%
Levofloxacin	1131	9.8%	
Azithromycin	714	6.2%	
Vanomycin HCl	4	0.03%	0.13%
Cefepime HCl	12	0.1%	
Total	11.565		

The main findings of this study reveal an imbalance in antibiotic use based on the AWaRe classification. Antibiotics in the Watch category accounted for the highest proportion, comprising 54.2% of total utilization. In contrast, Access antibiotics recommended as first-line options accounted for only 45.78%. The 45.78% proportion of Access antibiotic use indicates that the minimum 60% target recommended by the World Health Organization (WHO) has not yet been achieved. The predominance of the Watch group (54.2%) suggests a tendency toward the use of broad-spectrum antibiotics, which in the long term may increase antimicrobial resistance. These findings are consistent with studies in developing countries that show that limited diagnostic capacity, empirical treatment practices, and imbalances in drug availability are the main factors contributing to the low use of Access antibiotics (Zikria et al., 2024).

Meanwhile, the use of Reserve antibiotics was very low, at 0.13%. The very low use of Reserve antibiotics is consistent with findings in several countries showing that these antibiotics are used only in severe infections and/or those caused by multidrug-resistant organisms. Because Reserve antibiotics are intentionally designated as last-line therapy, their low proportion reflects antimicrobial stewardship principles aimed at preserving antibiotic effectiveness and preventing the development of resistance (Ines et al., 2021). These results indicate that the proportion of Access antibiotic use (45.78%) is substantially below the WHO's minimum target of 60% as an indicator of appropriate national antibiotic stewardship practices.

This study aims to describe the pattern of antibiotic use in a community pharmacy in the Province of West Nusa Tenggara using the WHO AWaRe classification and to evaluate the proportion

of Access-group antibiotic use relative to the global target. The main findings indicate that the antibiotic utilization pattern in the pharmacy does not align with WHO recommendations. The dominance of Watch-group antibiotics (54.2%), driven largely by Cefixime (38.2%), and the low proportion of Access-group antibiotics (45.78%) suggest suboptimal prescribing practices at the primary care level.

Cefixime, a broad-spectrum third-generation cephalosporin, should not be a routine choice for common infections that can be treated using narrow-spectrum Access antibiotics. This tendency reflects the overuse of broad-spectrum antibiotics, which may accelerate the development of antimicrobial resistance (AMR). These findings show a pattern similar to a study conducted in Kinshasa by Kakumba et al. (2023), where the proportion of Access-group antibiotic use was only 36.5%, while Watch-group antibiotics dominated at 43.2%, and 20.3% of antibiotics fell into the "not recommended" category (Kakumba et al., 2023). This demonstrates that low adherence to the AWaRe guidelines is not merely a local issue, but part of a broader global trend. The high use of Watch-group antibiotics must be addressed because it increases the risk of antimicrobial resistance. Therefore, stewardship efforts should focus on increasing the use of Access-group antibiotics and restricting the use of Watch and Reserve antibiotics in accordance with WHO recommendations (Mugada et al., 2021). This study also provides important insight into the contradictory antibiotic utilization data reported in Indonesia.

Table 2
Comparison of AWaRe Antibiotic Ultilization Proportions (%)

AWeRe Category	Findings of This Study (%)	WHO Targets	Findings from RSUI Study (%) (Syafhan et al., 2025)	National Survey Findings (%) (Rahmadi et al., 2024)
Access	45.78	≥ 60	14.8	66.8
Watch	54.2	-	85.0	33.1
Reserve	0.13	-	0.19	0.05

As shown in Table 2, the findings of this study (45.8% Access, 54.2% Watch) contrast sharply with national survey data from the Indonesian National Agency of Drug and Food Control (BPOM), which reported an Access proportion of 66.8% (Rahmadi et al., 2024). However, the results of the present study are highly consistent with data from hospital settings in Indonesia, where the use of Watch-group antibiotics is extremely high, reaching 85.0% at RSUI (Syafhan et al., 2025). This discrepancy may be attributed to the national sampling method, which relies on total sales volume and may thus be skewed by the high-volume sales of inexpensive generic Access antibiotics. In contrast, facility-level, prescription-based studies such as this one more accurately reflect actual prescriber preferences. The high use of Cefixime in this study strongly supports other findings indicating an increasing trend in cephalosporin and fluoroquinolone consumption in Indonesia (Limato, Broom, et al., 2022). The use of Cefixime in this study is consistent with the global study by Hsia et al. (2019), which reported a high utilization of third-generation cephalosporins among hospitalized pediatric patients across 56 countries. In that study, ceftriaxone was the most frequently prescribed antibiotic among children worldwide. This pattern indicates a global trend toward a shift from narrow-spectrum to broad-spectrum antibiotics in empirical therapy (Yingfen et al., 2019). Therefore, micro-level studies are essential for identifying real problems in the field that macro-level data may obscure.

The findings of this study highlight a gap between national policies and actual practices in the field. A survey conducted in Yogyakarta reported that although pharmacists hold positive perceptions regarding their role in ensuring the rational use of antibiotics, weaknesses remain in

interprofessional collaboration with physicians and in the practice of dispensing antibiotics without a prescription (Limato, et al., 2022; Luhraimaduretnoasvinigita et al., 2019)These conditions reinforce the results of the present study, which demonstrate the dominance of Watch-group antibiotic use particularly Cefixime thereby emphasizing the need for greater attention to the implementation of prudent antibiotic use at the community level. The implications of these findings underscore the importance of strengthening strategies to promote more rational antibiotic use in primary healthcare facilities. Such efforts may include improving adherence to national prescribing guidelines, implementing continuous monitoring using the AWaRe classification, and providing education and training for healthcare workers regarding appropriate antibiotic use principles. Thus, this study provides an important basis for decision-making and policy development to support antimicrobial resistance control programs, particularly at the community level.

Conclusion

The antibiotic utilization pattern observed in the community pharmacy showed a predominance of Watch-group antibiotics at 54.2%, driven by Cefixime. The proportion of Access-group antibiotic use reached only 45.78%, well below the WHO global target of 60%. Although derived from a single location, these findings indicate a potentially wider issue in prescribing practices within primary care settings, one that may not be fully captured by national aggregate data and is more aligned with patterns commonly observed in hospital environments. Therefore, optimization of Access-group antibiotic use in accordance with WHO guidelines is urgently needed. In this regard, the study underscores the importance of implementing AWaRe-based antibiotic stewardship policies to curb the progression of antimicrobial resistance and support the achievement of global goals for safe, effective, and well-controlled antibiotic use.

Acknowledgments

This study utilized anonymous secondary data obtained from prescription archives; therefore, it did not involve direct interaction with human subjects and did not require informed consent, which is the agreement provided by research subjects after receiving complete information regarding the study's objectives, procedures, potential risks, benefits, and their rights as participants. All patient and prescriber confidentiality was maintained in accordance with applicable research ethical principles. The authors hereby declare that there is no conflict of interest in the preparation or reporting of this study.

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