INTERNATIONAL JOURNAL OF RESEARCH AND SCIENTIFIC INNOVATION (IJRSI)
ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XIII Issue VII July 2026

Antibiotic Prescribing Patterns among Outpatients According to the WHO's AWaRe (Access, Watch, Reserve) Classification at Chiúre District Hospital, Cabo Delgado, Mozambique

***Nelson Domingos Cote[1,2,3], Ramim Xavi[3], Ciscêncio Botão[3], Alberto Pahula[3], Mussagy Miraz Pinto Issufo[3], Álvaro da Costa Rosa Alberto[3], Samito Simões Sebastião[3], Delfina Augusto Virgílio[3], Sancho Xavier[4]**

[1]Gonçalo Moniz Institute, Oswaldo Cruz Foundation, 121 Waldemar Falcão Street, Candeal, Salvador, BA, 40296-710, Brazil.

[2]Faculty of Medicine of Bahia, Federal University of Bahia, Dr. Augusto Viana Street, Canela, Salvador, BA, 40301-155, Brazil

[3]Zambeze University – Faculty of Health Sciences, Josina Machel Neighborhood, Provincial Hospital Campus, Tete City, Tete Province, Mozambique.

[4]School of Public Health, University of São Paulo (USP), 715 Doutor Arnaldo Avenue, São Paulo, São Paulo, 01246-904, Brazil

***Corresponding Author**

DOI: https://doi.org/10.51244/IJRSI.2026.1307000097

Received: 24 April 2026; Accepted: 30 April 2026; Published: 30 July 2026

ABSTRACT

Background: The inappropriate use of antibiotics is one of the main factors associated with the rise in antimicrobial resistance, which the World Health Organisation considers to be one of the greatest threats to global public health. To promote the rational use of these medicines, the WHO has developed the AWaRe classification (Access, Watch and Reserve), which provides guidance on the prescription of antibiotics according to their potential to induce resistance and their therapeutic importance.

Objective: To assess antibiotic prescribing patterns among outpatients using the World Health Organisation's AWaRe classification at Chiúre District Hospital, located in Cabo Delgado Province, Mozambique.

Methods: A retrospective study was conducted based on the analysis of secondary data from the medical records of patients treated on an outpatient basis between March and September 2025. A total of 449 prescriptions from patients of different age groups were analysed. The prescriptions were assessed using the WHO's AWaRe classification and the WHO/INRUD Prescribing Indicators. Statistical analyses were conducted using descriptive statistics with the R software.

Results: Of 449 patients, 33.6% were aged under 5 years, with a balanced sex distribution. Amoxicillin (40.8%), co-trimoxazole (26.2%), and metronidazole (8.3%) were the most prescribed antibiotics. Respiratory conditions were the most frequent diagnosis (39.3%). Most prescriptions were from the Access group (86.9%), followed by Watch (11.7%) and unclassified agents (1.5%).

Conclusion: Antibiotic prescribing was largely aligned with WHO AWaRe recommendations, with a predominance of Access antibiotics. However, the use of Watch antibiotics and gaps in clinical documentation indicate opportunities to strengthen prescribing oversight, professional training, and record-keeping to support rational antibiotic use.

Keywords: Antimicrobial resistance; Antibiotics; AWaRe classification; Rational prescribing; Antibiotic use; Outpatient care

INTRODUCTION

Antibiotics play a crucial role in the treatment of bacterial infections and have significantly contributed to reducing morbidity and mortality associated with infectious diseases worldwide[1–3]. The inappropriate and excessive use of these medications has contributed to the emergence and spread of antimicrobial resistance, which is currently considered one of the greatest threats to global public health by the World Health Organization (WHO)[4–6].

Antimicrobial resistance occurs when microorganisms develop the ability to resist the effects of the drugs used to treat them, making infections harder to treat and increasing the risk of complications, prolonged hospital stays, and mortality[5,7]. Among the main factors contributing to this problem are the inappropriate prescribing of antibiotics, empirical use without diagnostic confirmation, and the lack of systematic monitoring of prescribing practices, especially in low- and middle-income countries[4].

With the aim of promoting the prudent use of antibiotics, the World Health Organization has developed the AWaRe classification (Access, Watch, and Reserve), which categorizes antibiotics according to their spectrum of activity, potential to induce resistance, and clinical importance[8,9]. The Access group includes antibiotics recommended as first-line treatments for common infections, which are expected to account for the majority of prescriptions [8]. The Watch group comprises antibiotics with the highest potential to induce resistance, and their use must be carefully monitored. The Reserve group, on the other hand, includes last-resort antibiotics intended for the treatment of severe infections caused by multidrug-resistant microorganisms[10–12].

In sub-Saharan African countries, including Mozambique, antibiotics are often used in resource-limited settings, where access to laboratory tests is limited and treatment decisions are based on clinical diagnoses [13,14]. This situation may encourage the empirical prescription of antibiotics and hinder the implementation of effective strategies for monitoring antimicrobial use [13–15].

In Mozambique, despite efforts to strengthen policies on the rational use of medicines, there are still gaps in the evidence regarding antibiotic prescribing patterns at the outpatient level, particularly in rural districts and regions with limited epidemiological data. A systematic assessment of prescribing practices can provide important information to guide interventions aimed at improving the quality of care and reducing the risk of antimicrobial resistance[16,17].

Given this context, the present study aimed to evaluate antibiotic prescribing patterns among outpatients using the World Health Organization's AWaRe classification at the Chiúre District Hospital in Cabo Delgado Province, Mozambique. Analysis of these data may contribute to strengthening local strategies for monitoring and promoting the rational use of antibiotics in the health system.

METHODS

Study design

A retrospective study was conducted based on the analysis of secondary data obtained from medical records. The study focused on patients treated on an outpatient basis at the Chiúre District Hospital, located in the district of Chiúre, Cabo Delgado Province, Mozambique.

The Chiúre District Hospital is a secondary-level healthcare facility that provides outpatient and inpatient services to the local population, including general medical consultations, specialized care, diagnosis and management of various clinical conditions, as well as the dispensing of medications.

Population size and sample size

The study included a total of 449 patients, including children and adults, who were treated on an outpatient basis at the study hospital. For this study, the sample size corresponded to the total number of eligible individuals included in the study.

Data collection and study variables

To analyze antibiotic prescribing, the World Health Organization (WHO) AWaRe classification and the WHO/INRUD Prescribing Indicators were used to assess prescribing patterns and the appropriateness of antibiotic use in relation to international recommendations.

Data were collected between March 2025 and September 2025, under the supervision of the principal investigator, using a standardized instrument that included patients' sociodemographic and clinical information, as well as details on the antibiotics prescribed during outpatient visits.

In cases where essential information was missing or incomplete in the medical records, the records were excluded from the analysis.

Statistical Analysis

Statistical analyses were performed using R software (R Foundation for Statistical Computing, Vienna, Austria) via the RStudio environment. Descriptive statistics, including absolute and relative frequencies (percentages), means, and standard deviations (SD), were applied for the presentation and interpretation of the results.

Ethical Approval and Informed Consent

The research protocol was approved by the Scientific Committee of Zambeze University, Faculty of Health Sciences, Department of Pharmacy. Subsequently, approval was obtained from the clinical administration of Chiúre District Hospital to conduct the study.

Due to the retrospective nature of the research, which was based exclusively on the analysis of previously recorded medical records and prescriptions, without direct contact with patients, obtaining individual informed consent was waived.

It should be noted that the study was conducted in accordance with the ethical principles established by the Declaration of Helsinki, ensuring the confidentiality, privacy, and anonymity of the information contained in the medical records used in the research.

RESULTS

Of the 449 patient prescriptions evaluated, all were included in the final analysis. The largest proportion of patients was in the under-5 age group, accounting for 151 (33.6%), followed by patients aged 5 to 14 years, with 110 (24.5%). The age groups of 25 to 59 years and 15 to 24 years accounted for 103 (22.9%) and 73 (16.3%), respectively, while patients aged 60 years or older accounted for 12 (2.7%). Regarding gender, the distribution was nearly balanced, with 225 (50.1%) female and 224 (49.9%) male patients. As for the prescriber category, most prescriptions lacked recorded information (348; 77.5%). Among those with available information, 85 (18.9%) were prescribed by General Medicine Technicians (GMT), 11 (2.4%) by students, and 5 (1.1%) by volunteers (GMT). The demographic characteristics of the patients are presented in **Table 1.**

Table 1: Demographic characteristics of the patients (N = 206)

Characteristics	n (%)
Age -years	
< 5	151 (33.6)
5 – 14	110 (24.5)
15 – 24	73 (16.3)
25 – 59	103 (22.9)
≥ 60	12 (2.7)
Sex	
Male	224 (49.9)
Female	225 (50.1)

Prescriber category	
Student	11 (2.4)
GMT	85 (18.9)
Volunteer (GMT)	5 (1.1)
No information	348 (77.5)

As shown in Figure **1**. Amoxicillin was the most commonly prescribed antibiotic, with 84 prescriptions (40.8%), followed by cotrimoxazole, with 54 (26.2%). Metronidazole was the third most commonly used, with 17 prescriptions (8.3%), followed by phenoxymethylpenicillin, with 14 (6.8%).

Other prescribed antibiotics included ciprofloxacin (11; 5.3%), azithromycin (10; 4.9%), and erythromycin (7; 3.4%). Benzathine penicillin was prescribed in 3 cases (1.5%), while griseofulvin was observed in 2 prescriptions (1%).

Some antibiotics had a very low prescription frequency, including tetracycline, procaine penicillin, nystatin, and chloramphenicol, each with 1 prescription (0.5%).

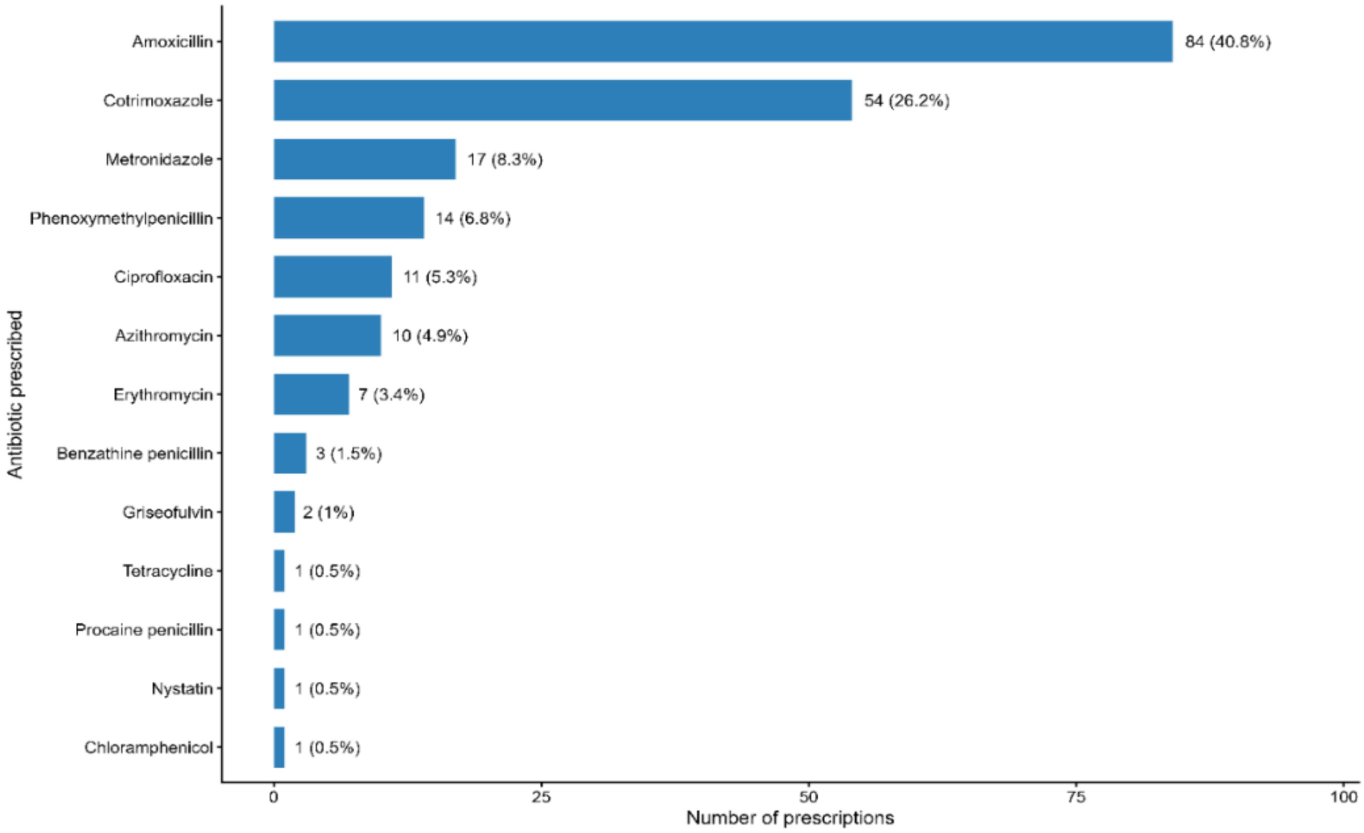

Figure 1: Most commonly prescribed types of antibiotics (N =206)

As shown in Table 2. Respiratory diseases were the most common diagnosis, accounting for 81 cases (39.3%). This was followed by injuries and accidents, with 24 cases (11.7%), and gastrointestinal diseases, with 16 cases (7.8%).

Febrile syndrome accounted for 15 cases (7.3%), while the “other diagnoses” category accounted for 14 (6.8%). Malaria was recorded in 8 cases (3.9%), and dermatological diseases in 6 cases (2.9%).

Other less frequent diagnoses included neurological diseases and sexually transmitted infections, each with 3 cases (1.5%), as well as urinary tract infection and mastitis, both with 2 cases (1.0%). In addition, ear disease, hypertension, and hernia were recorded in 1 case each (0.5%).

It was also observed that 29 prescriptions (14.1%) did not include a diagnosis or recorded clinical information.

Table 2: Distribution of diagnoses among patients prescribed antibiotics (N = 206)

Diagnosis	n	(%)
Respiratory diseases	81	39.3
Injuries and accidents	24	11.7
Gastrointestinal diseases	16	7.8
Fever syndrome	15	7.3
Other	14	6.8
Malaria	8	3.9
Skin diseases	6	2.9
Neurological diseases	3	1.5
Sexually transmitted infection	3	1.5
Urinary tract infection	2	1.0
Mastitis	2	1.0
Ear disease	1	0.5
Hypertension	1	0.5
Hernia	1	0.5
No diagnosis/information	29	14.1

Note: Respiratory diseases include ("Respiratory infection," "Pneumonia," "Flu," "Rhinitis," "Throat infection," "Asthma")

As shown in Table 3. Amoxicillin was found to be the most frequently prescribed antimicrobial, particularly for respiratory diseases (40 prescriptions), followed by injuries and accidents (23 prescriptions), and febrile syndrome (7 prescriptions).

Cotrimoxazole was also widely used, primarily in the treatment of respiratory diseases (31 prescriptions) and febrile syndrome (9 prescriptions). Metronidazole was most frequently prescribed for gastrointestinal diseases, with 10 prescriptions, making it the most commonly used antibiotic for this type of diagnosis.

Some antimicrobials had more specific uses. Ciprofloxacin was used primarily for gastrointestinal diseases, urinary tract infections, mastitis, and febrile syndrome. Azithromycin was prescribed for ear infections, neurological diseases, sexually transmitted infections, respiratory diseases, other diagnoses, and cases with no reported diagnosis.

Other antimicrobials, such as erythromycin, griseofulvin, nystatin, benzathine penicillin, procaine penicillin, phenoxymethylpenicillin, tetracycline, and chloramphenicol, were prescribed less frequently and distributed across different clinical diagnoses.

Table 4 presents the distribution of prescribed antibiotics according to the AWaRe classification. It was observed that the majority of prescribed antibiotics belonged to the Access group, totaling 179 prescriptions (86.9%), followed by the Watch group, with 24 (11.7%), while 3 (1.5%) were classified as Unclassified.

Among the antibiotics in the Access group, amoxicillin was the most prescribed, with 84 prescriptions (40.8%), followed by cotrimoxazole, with 54 (26.2%), and metronidazole, with 17 (8.3%). Other antibiotics in this group included phenoxymethylpenicillin (14; 6.8%), erythromycin (7; 3.4%), chloramphenicol, procaine penicillin, and tetracycline, all of which were prescribed less frequently.

In the Watch group, azithromycin stood out with 10 prescriptions (4.9%) and ciprofloxacin with 11 (5.3%), in addition to benzathine penicillin with 3 (1.5%).

Among the unclassified antimicrobials, griseofulvin (2; 1.0%) and nystatin (1; 0.5%) were identified.

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XIII Issue VII July 2026

Table 3: Antibiotics prescribed according to the AWaRe classification (N = 206)

Antibiotics	**Access**	**Watch**	**Unclassified**	**Total n (%)**
Amoxicillin	84	0	0	84 (40.8)
Co-trimoxazole	54	0	0	54 (26.2)
Metronidazole	17	0	0	17 (8.3)
Phenoxymethylpenicillin	14	0	0	14 (6.8)
Erythromycin	7	0	0	7 (3.4)
Chloramphenicol	1	0	0	1 (0.5)
Procaine penicillin	1	0	0	1 (0.5)
Tetracycline	1	0	0	1 (0.5)
Ciprofloxacin	0	11	0	11 (5.3)
Azithromycin	0	10	0	10 (4.9)
Benzathine penicillin	0	3	0	3 (1.5)
Griseofulvin	0	0	2	2 (1.0)
Nystatin	0	0	1	1 (0.5)
Total	**179 (86.9)**	**24 (11.7)**	**3 (1.5)**	**206 (100)**

Note: Access = first-line antibiotics recommended by the WHO; Watch = antibiotics with higher potential to induce resistance; Unclassified = not classified by the WHO.

As shown in Table 5, it was observed that the majority of prescriptions were for patients under 5 years of age, totaling 77 (37.4%), with 74 belonging to the Access group and 3 to the Watch group.

Among patients aged 5 to 14 years, 42 prescriptions (20.4%) were recorded, of which 36 belonged to the Access group, 4 to the Watch group, and 2 to the Unclassified group.

In the 15- to 24-year-old age group, 36 prescriptions (17.5%) were observed, including 23 antibiotics from the Access group, 12 from the Watch group, and 1 from the Unclassified group.

Among patients aged 25 to 59, 42 prescriptions (20.4%) were recorded, with the Access group accounting for the majority (37 prescriptions), followed by the Watch group (5 prescriptions).

Finally, in the age group of 60 years and older, 9 prescriptions (4.4%) were recorded, all of which belonged to the Access group.

Table 5: Antibiotic prescribing by age group and AWaRe classification (N= 206)

Age group	**Access**	**Watch**	**Unclassified**	**Total n (%)**
<5 years	74	3	0	77 (37.4)
5–14 years	36	4	2	42 (20.4)
15–24 years	23	12	1	36 (17.5)
25–59 years	37	5	0	42 (20.4)
≥60 years	9	0	0	9 (4.4)

As shown in Table 6, antibiotic use was significantly associated with age, professional category, department, and clinical diagnosis. Individuals aged 25–59 years had lower odds of antibiotic use compared to children under 5 years (OR=0.17; 95% CI: 0.03–0.93; p=0.048). Volunteers also showed reduced odds (OR<0.01; 95% CI: 0.00–

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XIII Issue VII July 2026

0.33; p=0.015). Compared to the emergency department, adult consultations were associated with lower antibiotic use (OR=0.10; 95% CI: 0.02–0.43; p=0.002).

Regarding diagnosis, malaria was strongly associated with reduced antibiotic use (OR=0.01; 95% CI: 0.00–0.10; p<0.01), while respiratory conditions were associated with substantially higher odds (OR=45.11; 95% CI: 2.51–7056; p=0.009). No significant associations were observed for sex or most other categories.

Table 6: Factors associated with antibiotic use

Characteristic	**OR**	**IC95%**	**p-value**
Age group			
<5 years	Ref.		
15 - 24 years	0.39	(0.05-2.53)	0.326
5 - 14 years	0.25	(0.05-1.03)	0.066
25 - 59 years	0.17	(0.03-0.93)	0.048
≥ 60 years	2.62	(0.01-1278)	0.851
Sex			
Female	Ref.		
Male	0.99	(0.39-2.51)	0.982
Professional category			
Student	Ref.		
GMT	0.08	(0.01-1.72)	0.105
Volunteer (GMT)	<0.01	(0.00-0.33)	0.015
Department			
Emergency Department	Ref.		
Sick Child Consultation (CCD)	0.29	(0.04-1.97)	0.204
Adult Consultation	0.10	(0.02-0.43)	0.002
Clinical diagnosis			
Gastrointestinal	Ref.		
Malaria	0.01	(0.00-0.10)	<0.01
Respiratory	45.11	(2.51-7056)	0.009
Syndromic	19.49	(0.89-3314)	0.06
Others	1.37	(0.19-8.40)	0.737

DISCUSSION

This study is one of the first analyses conducted at Chiúre District Hospital in Cabo Delgado Province, in northern Mozambique, to assess antibiotic prescribing patterns among outpatients using the World Health Organization's (WHO) AWaRe (Access, Watch, Reserve) classification. The results showed a predominance of antibiotics from the Access group, in line with the World Health Organization's recommendation that at least 60% of total antibiotic consumption belong to this group[16]. 86.9% of prescriptions were for antibiotics in the Access group, suggesting general alignment with international recommendations for the rational use of antimicrobials[18,19]. However, some shortcomings were observed regarding incomplete prescription records and the absence of a diagnosis in some cases factors that may compromise the quality of care and hinder proper monitoring of antibiotic use[20–22].

A higher concentration of prescriptions was observed among children under 5 years of age, followed by patients aged 5 to 14 years, indicating greater antibiotic use in pediatric populations. This pattern has also been described in studies conducted in other Sub-Saharan African countries, where children are more vulnerable to infectious diseases, such as respiratory and gastrointestinal infections[23]. The high proportion of prescriptions in this age group may be linked to the high incidence of infectious diseases in childhood and the common practice of empirical prescribing in settings with limited access to laboratory tests[24,25].

The multivariable analysis suggests that antibiotic prescribing is influenced by clinical and contextual factors. Lower odds among individuals aged 25–59 years compared to children under five may reflect a more cautious approach in pediatric care, while reduced prescribing among volunteers may indicate differences in training or guideline adherence.

Variation between adult consultations and the emergency department suggests differences in prescribing practices. The higher use of antibiotics in respiratory conditions highlights ongoing challenges in settings with limited diagnostic capacity.

Among the prescribed antibiotics, amoxicillin was the most commonly used drug, followed by cotrimoxazole and metronidazole. This pattern is similar to that observed in several studies conducted in low- and middle-income countries, where these drugs form the basis of treatment in primary health care[26,27]. The widespread use of amoxicillin is due to its effectiveness in treating common respiratory infections and its inclusion on the WHO's list of essential medicines [11]. Similarly, co-trimoxazole continues to be widely used in the treatment of various bacterial infections and as prophylaxis in certain clinical settings [9].

With regard to clinical diagnoses, respiratory diseases accounted for the majority of antibiotic prescriptions, representing nearly two-fifths of cases. This finding is consistent with studies conducted in various African countries, in which respiratory infections rank among the leading causes of outpatient visits and antibiotic prescriptions[28,29]. However, many of these conditions have a viral cause, which can lead to the unnecessary prescription of antibiotics when the diagnosis is based solely on clinical criteria [5].

Analysis of antibiotics according to the AWaRe classification showed that the vast majority belonged to the Access group, including amoxicillin, cotrimoxazole, metronidazole, and penicillins. This finding suggests a relatively appropriate use of first-line antibiotics in the outpatient setting[18]. The Watch group was represented primarily by azithromycin and ciprofloxacin, drugs that have a higher potential to induce antimicrobial resistance and should therefore be used with greater caution. Although the proportion of antibiotics in this group was relatively low (11.7%), their use must be continuously monitored. No prescriptions for antibiotics in the Reserve group were observed, which is a positive result, considering that these drugs are intended for the treatment of severe and multidrug-resistant infections, usually in a hospital setting[18,19].

The distribution of antibiotic prescriptions by age group showed a predominance of the Access group across all age groups, particularly among children under five years of age. This finding reinforces the expected treatment pattern in primary care, where antibiotics with a relatively narrower spectrum of activity are preferred as first-line treatment[11]. However, the presence of antibiotics in the Watch group in certain age groups, particularly among young adults, suggests a need to strengthen strategies for monitoring prescribing practices [11,18,19].

Another significant finding identified in this study was the high proportion of prescriptions lacking information about the prescriber, accounting for more than three-quarters of the records analyzed. This limitation may reflect weaknesses in the clinical record system and hinders a more detailed assessment of prescribing practices[30]. Among the prescriptions for which data is available, general practitioners accounted for the majority of cases, reflecting the structure of the Mozambican healthcare system, where these professionals play a key role in providing primary care[31,32].

Given the growing challenge of antimicrobial resistance, it is essential to strengthen antimicrobial stewardship strategies in healthcare facilities. The systematic implementation of the AWaRe classification in treatment protocols, the conduct of periodic prescription audits, and the enhancement of continuing education for healthcare professionals are key measures for promoting the rational use of antibiotics[33,34]. In addition, improving laboratory infrastructure for diagnostic confirmation can help reduce empirical prescribing and improve treatment accuracy [35].

This study has some limitations. As it is a retrospective analysis based on medical records, there may have been omissions or inconsistencies in the records, as evidenced by the absence of information on the prescriber and diagnosis in some of the prescriptions. Furthermore, the study was conducted at a single healthcare facility, which may limit the generalizability of the results to other regions of the country. The lack of microbiological data also prevents the assessment of therapeutic appropriateness based on etiological confirmation. Despite these limitations, the study provides important evidence on antibiotic prescribing patterns at the outpatient level in northern Mozambique and contributes to the strengthening of national strategies aimed at the rational use of antimicrobials.

CONCLUSION

Antibiotic prescribing was largely aligned with WHO AWaRe recommendations, with predominance of Access antibiotics. However, prescribing was shaped by clinical and contextual factors, with higher use in young children and in respiratory conditions. Lower odds in adults and in non-emergency settings suggest heterogeneity in prescribing practices. The presence of Watch antibiotics and gaps in clinical documentation highlight areas for improvement. Strengthening antimicrobial stewardship, routine prescription audit, and diagnostic capacity is essential to optimise antibiotic use and mitigate antimicrobial resistance in this setting.

Data Availability

The datasets used and/or analyzed in this study are available upon reasonable request to the corresponding author.

Abbreviations

AWaRe – Access, Watch and Reserve

WHO – World Health Organization

LMEM – Mozambique's List of Essential Medicines (or the list for the country under study; adjust as necessary)

GMT – General Medicine Technicians

REFERENCES

1. Carey GB, Holleck JL, Alshaeba SE, et al. Estimated mortality with early empirical antibiotic coverage of methicillin-resistant Staphylococcus aureus in hospitalized patients with bacterial infections: a systematic review and meta-analysis. Journal of Antimicrobial Chemotherapy 2023;78:1150–9. https://doi.org/10.1093/jac/dkad078.
2. Londoño J, Niño C, Archila A, et al. Antibiotics has more impact on mortality than other early goal-directed therapy components in patients with sepsis: An instrumental variable analysis. J Crit Care 2018;48:191–7. https://doi.org/10.1016/j.jcrc.2018.08.035.
3. Hemminki E, Paakkulainen A. The Effect of Antibiotics on Mortality From Infectious Diseases In Sweden and Finland. 1976.
4. WHO. Global Antimicrobial Resistance and Use Surveillance System (GLASS) Report 2022. World Health Organization; 2022.
5. WHO. Global antibiotic resistance surveillance report 2025 WHO Global Antimicrobial Resistance and Use Surveillance System (GLASS). 2025.
6. Gahimbare L, Muvunyi CM, Guessennd NAK, et al. Antimicrobial Resistance in the WHO African Region: A Systematic Literature Review 2016–2020. Antibiotics 2024;13. https://doi.org/10.3390/antibiotics13070659.
7. Murray CJ, Ikuta KS, Sharara F, et al. Global burden of bacterial antimicrobial resistance in 2019: a systematic analysis. The Lancet 2022;399:629–55. https://doi.org/10.1016/S0140-6736(21)02724-0.
8. Bansal A, Sharma R, Prakash R. Adoption of the World Health Organization access, watch reserve index to evaluate and monitor the use of antibiotics at a tertiary care hospital in India. Perspect Clin Res 2022;13:90–3. https://doi.org/10.4103/picr.PICR_202_19.
9. WHO-MHP-HPS-EML-2023.04-eng n.d.

10. Hsia Y, Lee BR, Versporten A, et al. Use of the WHO Access, Watch, and Reserve classification to define patterns of hospital antibiotic use (AWaRe): an analysis of paediatric survey data from 56 countries. Lancet Glob Health 2019;7:e861–71. https://doi.org/10.1016/S2214-109X(19)30071-3.
11. WHO-HMP-HPS-EML-2021.04-eng (1) n.d.
12. WHO-EMP-IAU-2019.11-eng n.d.
13. Do NTT, Vu HTL, Nguyen CTK, et al. Community-based antibiotic access and use in six low-income and middle-income countries: a mixed-method approach. Lancet Glob Health 2021;9:e610–9. https://doi.org/10.1016/S2214-109X(21)00024-3.
14. Nepal A, Bhandari N, Subedi R, et al. Antibiotics Use Patterns in Low- and Middle-Income Countries: A Systematic Review Analysis. Inquiry 2026;63. https://doi.org/10.1177/00469580261420724.
15. Ardillon A, Ramblière L, Kermorvant-Duchemin E, et al. Inappropriate antibiotic prescribing and its determinants among outpatient children in 3 low- and middle-income countries: A multicentric community-based cohort study. PLoS Med 2023;20. https://doi.org/10.1371/journal.pmed.1004211.
16. Infographics WA. The WHO The WHO A AWa WaRe Re ((Access Access, Watch Watch, Reserve Reserve)) antibiotic book antibiotic book. 2022.
17. Ghanem M, Dubé JY, Wang J, et al. Heterologous production of 1-tuberculosinyladenosine in mycobacterium kansasii models pathoevolution towards the transcellular lifestyle of mycobacterium tuberculosis. MBio 2020;11:1–15. https://doi.org/10.1128/mBio.02645-20.
18. Moja L, Zanichelli V, Mertz D, et al. WHO's essential medicines and AWaRe: recommendations on first- and second-choice antibiotics for empiric treatment of clinical infections. Clinical Microbiology and Infection 2024;30:S1–51. https://doi.org/10.1016/j.cmi.2024.02.003.
19. Benkő R, Matuz M, Pető Z, et al. Trends in the hospital-sector consumption of the WHO AWaRe Reserve group antibiotics in EU/EEA countries and the. 2010.
20. Brown T, Guzman A, Lee JY, et al. Clinicians' Reasons for Non-Visit-Based, No-Infectious-Diagnosis-Documented Antibiotic Prescribing: A Sequential Mixed-Methods Study. Antibiotics 2025;14. https://doi.org/10.3390/antibiotics14080740.
21. Ray MJ, Tallman GB, Bearden DT, et al. Antibiotic prescribing without documented indication in ambulatory care clinics: national cross sectional study. BMJ 2019;367:l6461. https://doi.org/10.1136/bmj.l6461.
22. Singh T, Banerjee B, Garg S, et al. A prescription audit using the World Health Organization-recommended core drug use indicators in a rural hospital of Delhi. J Educ Health Promot 2019;8. https://doi.org/10.4103/jehp.jehp_90_18.
23. Ray MJ, Tallman GB, Bearden DT, et al. Antibiotic prescribing without documented indication in ambulatory care clinics: national cross sectional study. BMJ 2019;367:l6461. https://doi.org/10.1136/bmj.l6461.
24. WHO Library Cataloguing-in-Publication Data Global Action Plan on Antimicrobial Resistance. 2015.
25. Chen H, Fu X. Dynamics study on the role of curcumin on TGF-β1 expression and pathological changes in acute paraquat poisoned rats. Exp Ther Med 2018;16:3841–6. https://doi.org/10.3892/etm.2018.6667.
26. WHO-MHP-HPS-EML-2021.02-eng n.d.
27. Klein EY, Van Boeckel TP, Martinez EM, et al. Global increase and geographic convergence in antibiotic consumption between 2000 and 2015. Proc Natl Acad Sci U S A 2018;115:E3463–70. https://doi.org/10.1073/pnas.1717295115.
28. Igirikwayo ZK, Migisha R, Mukaga H, et al. Prescription patterns of antibiotics and associated factors among outpatients diagnosed with respiratory tract infections in Jinja city, Uganda, June 2022–May 2023. BMC Pulm Med 2024;24. https://doi.org/10.1186/s12890-024-03246-9.
29. Kasse GE, Cosh SM, Humphries J, et al. Antimicrobial prescription pattern and appropriateness for respiratory tract infection in outpatients: a systematic review and meta-analysis. Syst Rev 2024;13. https://doi.org/10.1186/s13643-024-02649-3.
30. Xin Y, Jiang J, Chen S, et al. What contributes to medical debt? Evidence from patients in rural China. BMC Health Serv Res 2020;20. https://doi.org/10.1186/s12913-020-05551-5.
31. Hartzler AL, Tuzzio L, Hsu C, et al. Roles and functions of community health workers in primary care. Ann Fam Med 2018;16:240–5. https://doi.org/10.1370/afm.2208.

32. de Fátima dos Santos A, da Rocha HA, de Lourdes Dayrellde LimaII ÂM, et al. Contribution of community health workers to primary health care performance in Brazil. Rev Saude Publica 2020;54:1–10. https://doi.org/10.11606/s1518-8787.2020054002327.
33. Sajjad U, Afzal N, Asif M, et al. Evaluation of antibiotic prescription patterns using WHO AWaRe classification. Eastern Mediterranean Health Journal 2024;30:156–62. https://doi.org/10.26719/emhj.24.031.
34. WORLD HEALTH ORGANIZATION. Global antibiotic resistance surveillance report 2025 WHO Global Antimicrobial Resistance and Use Surveillance System (GLASS). 2025.

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XIII Issue VII July 2026

ANEXES

Table 4: Antimicrobials prescribed according to clinical diagnosis

Diagnosis	Amoxicillin	Azithromycin	Benzathine Penicillin	Chloramphenicol	Ciprofloxacin	Cotrimoxazole	Erythromycin	Griseofulvin	Metronidazole	Nystatin	Phenoxymethylpenicillin	Procaine penicillin	Tetracycline
Ear disease	0	1	0	0	0	0	0	0	0	0	0	0	0
Skin diseases	0	0	0	0	0	0	2	2	0	0	1	0	0
Gastrointestinal diseases	1	0	0	0	4	1	0	0	10	0	0	0	0
Neurological diseases	1	1	1	0	0	0	0	0	0	0	0	0	0
Respiratory diseases	40	3	0	0	0	31	0	0	0	0	7	0	0
Hernia	0	0	0	0	0	0	0	0	0	0	0	0	0
Hypertension	0	0	0	0	0	0	0	0	1	0	0	0	0
Sexually transmitted infection	0	1	1	0	0	0	0	0	0	0	0	0	0
Urinary tract infection	0	0	0	0	1	0	0	0	0	0	0	0	0
Injuries and accidents	23	0	0	0	0	0	1	0	0	1	0	0	0
Malaria	1	0	0	0	0	1	0	0	1	0	1	0	0
Mastitis	0	0	0	0	1	0	1	0	0	0	0	0	0
Other	4	1	0	1	1	3	1	0	1	0	1	0	0
No diagnosis/information	7	3	1	0	1	1	0	0	0	0	0	0	0
Fever syndrome	7	0	0	1	3	9	0	0	2	0	3	1	1