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Review Article

Antibiotic prescription patterns and barriers to rational antibiotic use in low and middle income countries: a scoping review

Bertrand N. Sangwe[1]*, Fanny N. Dissak Delon[1], Pride T. Bobga[2], Fabrice A. Ngwa[2], Flore N. Ngoufo[3,4]

[1]Department of Public Health, Faculty of Health Sciences, The University of Bamenda, Bambili, Bamenda, Cameroon
[2]Department of Microbiology and Parasitology, University of Buea, Buea, Cameroon
[3]Department of Biomedical Sciences, The University of Bamenda, Bambili, Bamenda, Cameroon
[4]Department of Medical Laboratory Science, The University of Bamenda, Bambili, Bamenda, Cameroon

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***Correspondence:**
Bertrand N. Sangwe,
E-mail: bertrandsangwe@yahoo.com

ABSTRACT

Antibiotics are central to reducing infection related mortality. However, misuse has fueled a global antimicrobial resistance (AMR) crisis with the greatest impact in low- and middle-income countries (LMICs), where healthcare systems are often under-resourced. The World Health Organization (WHO) and International Network for Rational Use of Drugs (INRUD) indicators, along with the WHO Access, Watch, and Reserve (AWaRe) classification, provide benchmarks for antibiotic use. This scoping review aimed at examining antibiotic prescription patterns as well as identifying barriers to appropriate prescribing in LMICs. A scoping review was conducted following PRISMA-ScR guidelines. PubMed and Scopus were searched for English language studies published between 2015 and July 2025. Eligible studies reported on prescription patterns using WHO/INRUD indicators, the WHO AWaRe classification, or barriers to appropriate antibiotic prescription. Data were charted and synthesized using descriptive statistics and content analysis. Forty-four (44) studies from twenty (20) LMICs were included in the scoping review. Antibiotic prescribing rates often exceeded the WHO optimal range of 20–26.8%, reaching as high as 94.9% in Sierra Leone. In 78.6% (11/14) of the studies reporting AWaRe classification, the WHO target of ≥60% prescription of access antibiotics was not met, while watch category antibiotics accounted for disproportionately high prescribing levels (>70%) in some countries. The key barriers to appropriate prescription identified in this review included poor prescriber knowledge and attitude, and inadequate access to diagnostics, treatment guidelines, and antibiotics. Antibiotic prescribing in LMICs is frequently suboptimal, with excessive reliance on broad-spectrum antibiotics from the watch category as a result of widespread system and prescriber-level barriers that influence appropriate antibiotic prescription. Strengthening diagnostics while ensuring reliable access to antibiotics, increasing access to updated guidelines, and engaging prescribers and communities through tailored stewardship programs are essential to improve antibiotic prescriptions in LMICs.

Keywords: Antibacterial agents, Antibacterial drug resistance, Inappropriate prescriptions, WHO/INRUD indicators, AWaRe classification

INTRODUCTION

Antibiotics have played a transformative role in modern medicine, drastically reducing mortality from bacterial infections and making previously dangerous procedures significantly safer. However, the misuse and overuse of these drugs have fueled the global crisis of antimicrobial resistance (AMR).[1,2] When a new antibiotic is introduced, it may be highly effective in treating infections caused by susceptible bacteria. However, as time goes on, the

bacteria develop resistance strategies in the presence of a selection pressure is present in their environment, as a result of the overuse and misuse of antibiotics.[3,4] This phenomenon of resistance developing in bacterial species over time hampers the initial effectiveness of antibiotics that were once effective in treating a particular infection. This can result in treatment failures, prolonged illnesses, and increased healthcare costs.[1,4] The combined threat of rising resistance and dwindling drug options presents a critical barrier to public health, particularly in low- and middle- income countries (LMICs) with under-resourced healthcare systems.[3] In 2019, it was estimated that approximately 4.95 million deaths were associated with bacterial AMR globally, of which around 1.27 million were directly caused by bacterial AMR.[5] The burden was highest in less developed regions such as Western sub-Saharan Africa, with an estimated 114.8 deaths per 100,000 linked to AMR. In contrast, developed regions like Australia reported the lowest burden of AMR, at approximately 28 deaths per 100,000.[5] Many studies show a significant over prescription of common antibiotics in developing countries, particularly in primary healthcare centers, despite established guidelines for prescription.[2,6,7] World Health Organization (WHO), in collaboration with the International Network for Rational Use of Drugs (INRUD), developed a series of selected indicators to evaluate drug usage in healthcare settings. The WHO/INRUD established essential prescribing indicators includes, the percentage of consultations where antibiotics are prescribed (optimal range of 20.0% to 26.8%).[8] WHO further developed the "Access, Watch, and Reserve" (AWaRe) framework which shows the WHO classification of antibiotics, which was introduced as part of the 2017 Model List of Essential Medicines. This AWaRe classification offers guidance on the optimal use of these antibiotics by adhering to the principles of Access, Watch, and Reserve categories of antibiotics.[9] Access antibiotics has a narrow spectrum of action, are affordability, and generally has a low potential for resistance. For these reasons, access antibiotics are suitable as empirical first or second-line treatment options for common infections such as skin and soft tissue infection (mild cases), lower urinary tract infection, and community-acquired pneumonia. In contrast, watch antibiotics are broader in spectrum and typically more expensive.[9,10] They are recommended mainly for severe infections with a higher likelihood of resistance to access antibiotics, such as upper urinary tract infections, infectious acute diarrhea, and enteric fever.[10] Reserve antibiotics are reserved for the most challenging cases for treating multidrug-resistant infections.[9,10] In addition to the aforementioned categories, there is a fourth group for antibiotics that are not recommended for treatment. This group is made up of fixed-dose combinations of various broad-spectrum antibiotics that are not evidence-based and are not endorsed by high-quality international guidelines, and WHO does not advocate for their use in clinical practice.[9,10] The WHO AWaRe classification serves as a valuable tool for assessing the appropriateness of antibiotic usage. According to WHO, at least 60% of global antibiotic consumption at the national level should come from the access category.[9,10] During a high-level meeting on antimicrobial resistance in September 2024, the United Nations General Assembly (UNGA) adopted a political declaration aiming for at least 70% of human antibiotics used globally to be from the WHO Access group by 2030.[11] The vast majority of prevalent infections encountered in primary health care can be managed without the use of antibiotics or with access antibiotics. It is essential to minimize the inappropriate utilization of watch antibiotics to combat antibiotic resistance effectively.[10] However, a significant number of prescribers fail to comply with the AWaRe guidelines, contributing to an increase in the prevalence of antibiotic-resistant microorganisms. The AWaRe guideline emphasizes the optimal utilization of access antibiotics, which continue to be the preferred treatment for the majority of infections. It suggests that nine out of the ten most prevalent infections encountered in primary health care can be effectively managed with either no antibiotics or access antibiotics.[9,10] The escalating rates of antibiotic resistance is becoming increasingly urgent, particularly in LMICs, which face significant obstacles in addressing this issue.[12-14] To effectively address antibiotic resistance, frontline healthcare professionals must navigate the complex task of fulfilling patient needs while adhering to best practices in antibiotic prescription and administration.[12-14] Reviews have been conducted to evaluate the effectiveness of interventions in reducing inappropriate antibiotic prescription, while others have synthesized current literature on antibiotic prescription, but these reviews focused on specific countries, high income countries or a mix of economic settings, making it difficult to understand the specific challenges faced by prescribers in LMICs, which is very important in designing targeted interventions and prescription policies to fight AMR in this highly affected setting.[1,4] In addition, reviews have not adequately explored antibiotic prescription patterns in this setting according to the WHO/INRUD prescribing indicators or the WHO AWaRe classification of antibiotics, which is very important.[8,9] Current literature on antibiotic prescription patterns should be reviewed using the WHO/INRUD prescribing indicators and the AWaRe classification. This will help assess whether these guidelines are being followed in LMICs and inform efforts to improve appropriate antibiotic prescription and combat AMR. In addition, existing evidence on the challenges faced by prescribers in LMICs in appropriately prescribing antibiotics should be examined to guide the design of effective interventions.

Given the likely differences across studies in design, context, and outcomes, a scoping review was undertaken to comprehensively map the available evidence on antibiotic prescribing and associated barriers in LMICs. This scoping review aimed to assess the evidence on antibiotic prescription patterns and barriers to performing appropriate antibiotic prescriptions by prescribers in LMICs.

METHODS

This scoping review was conducted and reported following the review protocol in accordance with the preferred reporting items for systematic reviews and meta-analyses extension for scoping reviews (PRISMA-ScR) checklist.[15] The search strategy was developed to identify relevant studies conducted in LMICs, as defined by the World Bank.[16] The search for records combined free-text terms with Boolean operators and were limited to studies published in English between January 2015 and July 2025. Two distinct search strings were used to search for records that address the review objective and questions. The search string searched for information sources on the barriers to appropriate antibiotic use, and the patterns of antibiotic prescription according to WHO/INRUD core prescription indicators and the WHO AWaRe antibiotic classification. This is shown in Table 1. The PubMed and Scopus were the databases searched for sources of evidence within the scope of this review.

Source of evidence selection and data extraction

The list of resource documents obtained through database search in PubMed and Scopus were exported in the form of CSV files and later imported to Zotero version 7.0.21, where duplicates were removed. The title and abstract of records were screened by two independent reviewers. Records were selected if they reported on antibiotic prescription in health facilities in LMICs. Selected records included those reporting on drug use indicators (WHO/INRUD, WHO AWaRe, or both), and those that assessed barriers to antibiotic prescription. The exclusion criteria included records addressing general pharmaceutical use without reporting on antibiotic use, as well as those that focused on specific syndromes such as respiratory infections and urinary tract infections. Records for which the full-text article could not be obtained were also excluded. In addition, review articles, including systematic reviews, scoping reviews, and narrative reviews, were excluded. After a title and abstract screen was conducted, a full text screen was then performed for detailed assessment of the records to determine if they met the inclusion criteria by two independent reviewers. Disagreements between reviewers were resolved through discussion or with the help of an additional reviewer. Data from the included sources of evidence were charted using a standardized data charting form to capture author information, study title, study objective, key findings and country of origin. Data charting was performed by one reviewer and checked by a second reviewer to ensure consistency and accuracy.

Data analysis and presentation

Qualitative content analysis and descriptive statistics were used to analyze the data, and key findings were presented in a summary table, figures and map. Results were organized according to sections to answer the two key review questions.

RESULTS

Search results and characteristics

Literature search on PubMed identified 390 studies, while a literature searches on Scopus identified 866 studies, giving a total of 1256 studies to be screened. After the identified studies were screened for duplicates, 893 studies were selected for title and abstract screen according to the inclusion criteria. The abstract screen was followed by a full-text screen of 55 articles to get the final 44 studies that were included in this review. Figure 1 provides an overview of the evidence selection process that resulted in the inclusion of 44 evidence sources in the review. Table 2 summarizes the characteristics of the studies included in the review and key findings.

The 44 selected studies that were included in this review came from 20 LMICs. Countries such as Ethiopia and Ghana had the maximum number of studies included in the review, followed by India, Jordan, Nigeria, Tanzania, and Uganda, with 3 studies each. Benin, Cambodia, Kenya, Laos, Nepal, Pakistan, and Zambia had 2 studies each in the review, with other countries such as Bangladesh, Cameroon, Democratic Republic of Congo (DR Congo), Sierraleone, Sudan, and Vietnam having a study in the review. A summary of the origin of studies included in the review is found in Figure 2.

The majority of studies included in this review were published between 2020 and the second quarter of 2025, with at least four publications per year. In contrast, fewer studies (20.4%) were published between 2015 and 2019, with only one study identified in 2015. Figure 3 presents the distribution of studies by year of publication, showing an increase in the number of relevant publications in recent years.

Antibiotic prescription patterns in LMICs

Studies included in the review covered multiple LMICs across Africa, Asia, and the Middle East. These studies included point prevalence surveys, cross-sectional prescribing audits, and antibiotic consumption studies in settings such as outpatient and inpatient departments in primary care and tertiary hospitals. To present findings on antibiotic prescription patterns across this setting, findings were organized according to the WHO/INRUD core prescribing indicator and the WHO AWaRe prescription indicators.

WHO/INRUD core prescribing indicator; proportion of patient encounters with at least an antibiotic prescribed

Across the included studies, the proportion of patient encounters receiving at least one antibiotic varied widely, ranging from 17.7% in Jordan to 94.9% in Sierra Leone. Most studies reported antibiotic prescription rates that exceeded the recommended optimal range of 20–26.8%. Notably high rates were observed in several studies,

including 94.8% (reported in three separate studies), 94.9%, 88.0%, 84.1%, 82.9%, 82.1%, 75.25%, 72.8%, and 70.0%.[2,17-23] Moderate rates such as 62.2%, 62%, 60.84%, 59.6%, 59.0%, and 55.2% were also reported.[6,14,24-27] A few studies reported rates that were closer to the WHO threshold, including, 49.0%, 47.8%, 44.7%, 44.5%, 36.71%, 36%, and 32.9%.[28-35] A study from Jordan, however, reported a low antibiotic prescription rate of 17.7%.[36] Overall, the pattern from these studies indicates that antibiotic prescribing in many LMIC settings remains considerably higher than the WHO recommended optimal range of 20–26.8%.[8] To further assess the appropriateness of antibiotic prescription in this setting beyond antibiotic prescription rates per patient encounter, the distribution of antibiotics according to the WHO Access, Watch, and Reserve (AWaRe) classification was also examined.

WHO AWaRe (Access, Watch, and Reserve) distribution

The percentage of antibiotics prescribed from the access group ranged from 25.7% to 74%. In the studies reviewed, the percentage of antibiotics categorized within the access group varied between 25.7% and 59.6% across 11 out of the 14 studies, whereas the other 3 studies, which were from Benin, Ghana, and Ethiopia, indicated proportions of 60% or higher.[2,7,18-23,25,30,32-34,37,38] In the majority (10/14) of the studies, antibiotics prescribed from the Watch group were notably high, with prescription rates exceeding 40% in most cases.[7,18,20-22,25,30,32,33,37] Particularly elevated proportions were reported in studies from Zambia (52%), Sudan (71.0%), and Sierra Leone (71.7%) [7,18,22]. The prescription of antibiotics from the reserve group of antibiotics was rare with 13 out of 14 studies reporting prescription rates of less than 1% from the reserve category.

However, a study from Pakistan reported 2.2% of antibiotic prescriptions from the reserve group.[20] The prescription of not-recommended antibiotic combinations according to the WHO AWaRe classification was reported in some studies, with prescription rates as high as 20.3% and 25.5% reported in studies from the Democratic Republic of Congo and Tanzania, respectively.[2,21]

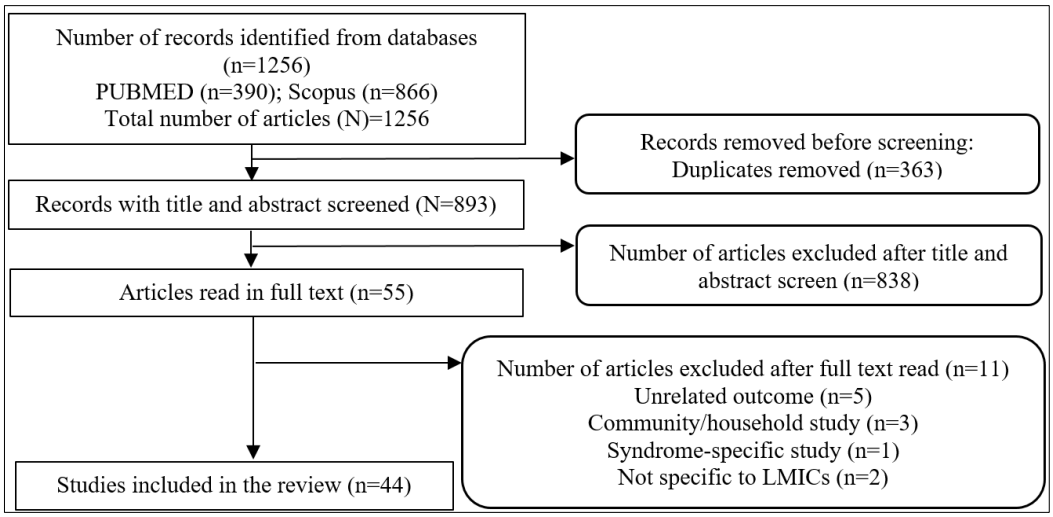
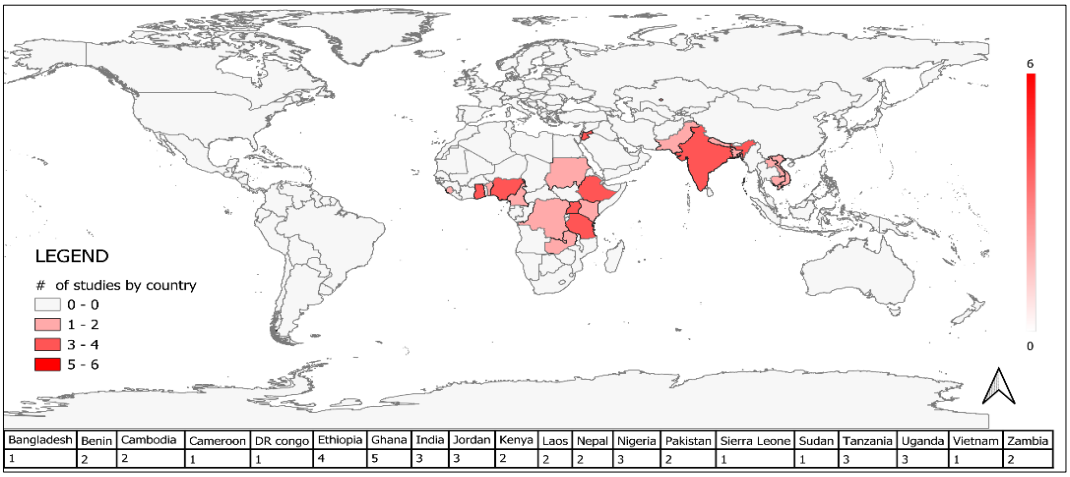


Figure 1: Preferred reporting items for systematic reviews and meta-analyses extension for scoping reviews (PRISMA-SCR) flow diagram.



Bangladesh	Benin	Cambodia	Cameroon	DR congo	Ethiopia	Ghana	India	Jordan	Kenya	Laos	Nepal	Nigeria	Pakistan	Sierra Leone	Sudan	Tanzania	Uganda	Vietnam	Zambia
1	2	2	1	1	4	5	3	3	2	2	2	3	2	1	1	3	3	1	2

Figure 2: Distribution of selected studies with regard to the country of origin.

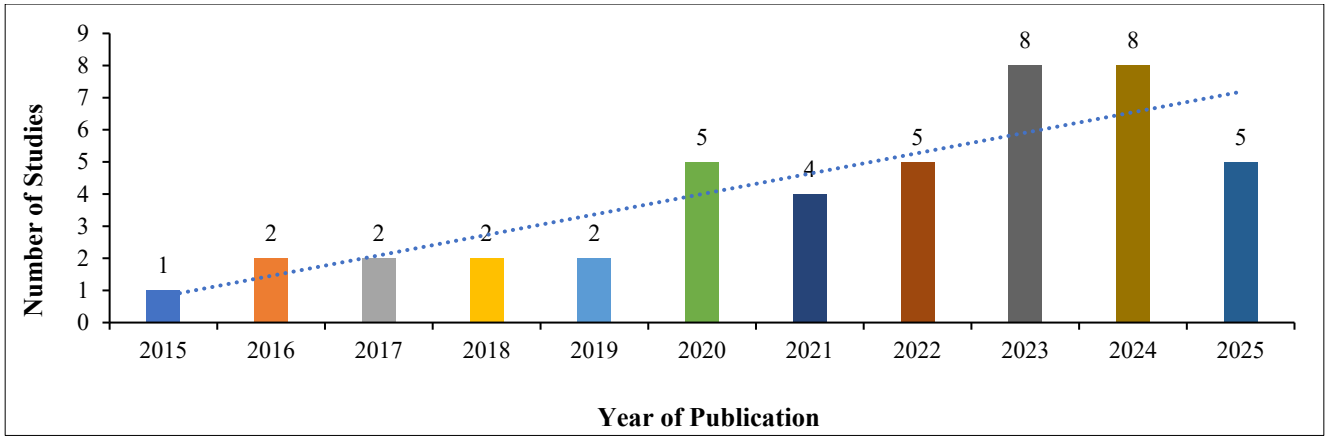


Figure 3: Distribution of selected studies by years of publication.

Barriers to appropriate antibiotic prescription

A total of 20 studies included in this review assessed barriers to appropriate antibiotic prescription. This review identified 11 key themes. The main themes identified includes; prescribers' knowledge and attitudes, inadequate access to diagnostics, Limited access to guidelines, and inadequate access to antibiotics. All themes identified in this review are shown in Table 3.

Prescribers' knowledge and attitudes were reported to influence appropriate antibiotic prescription. Limited knowledge of prescribers on appropriate antibiotic prescription, and inadequate continuous education programs were reported as factors that affected appropriate antibiotic prescription by prescribers.[12,13,39,40-42] Antibiotic prescription was also reported to be influenced by prescribers' perception of resistance to narrow-spectrum antibiotics, resulting in a preference for broad-spectrum antibiotics to ensure it covers all possible infections.[13,31,43-45] Senior colleagues were also reported by junior staff to play a key role in inappropriate antibiotic prescription.[37,43] Other prescriber-related factors, such as poor compliance with treatment guidelines, were reported in Zambia as a barrier to appropriate antibiotic prescriptions in health facilities.[14]

Inadequate access to diagnostics was reported among the studies included in the review. Limited access to microbiology laboratory services, long culture results turnaround time, and the absence of sensitivity testing were reported to affect appropriate antibiotic prescription.[14,19,31,39,43,44,46-48] Across studies, antibiotic prescribing was frequently based on empirical therapy, with limited use of laboratory results to guide treatment decisions.[12,14,43,44,46,48-50]

Limited access to guidelines was commonly reported. An association between inadequate access to treatment guidelines and appropriate antibiotic prescription at healthcare facilities was reported in a study in Kenya, with poor access to up-to-date guidelines identified as a barrier to appropriate antibiotic prescription. This study carried out in Kenya by Maina et al further showed that patients were about 6 times more likely to be prescribed antibiotics appropriately if prescribers had access to treatment guidelines.[51] The poor access to up-to-date or evidence-based guidelines was reported in a series of studies in LMICs as a barrier to appropriate antibiotic prescription.[12-14,43,46,52]

Inadequate access to antibiotics was identified as a key barrier to appropriate antibiotic prescription in studies from Ethiopia, Nigeria, Laos, and India. These studies highlighted that poor access to antibiotics restricts prescribers' ability to follow treatment guidelines and policies, resulting in inappropriate antibiotic prescription through the use of less suitable antibiotic alternatives.[12,39,46,47,50,53]

Inadequate monitoring and support systems in place for continuous monitoring, supervision, and motivation of prescribers were reported as a major barrier to appropriate antibiotic prescription in LMICs. This was reported in studies from Nigeria, Uganda, and Tanzania.[13,46,54]

Financial incentives from pharmaceutical companies were reported as contributing factors that hinder the appropriate prescription of antibiotics in studies from Nigeria, Nepal, and Uganda. These factors were reported to encourage prescribers to favor specific antibiotic brands or broad-spectrum agents, irrespective of clinical indication, for financial gain.[13,46,47]

High workload was also reported to affect appropriate antibiotic prescription in studies from India and Ethiopia.[12,50]

Out-of-pocket payments by patients were identified as one of the barriers to appropriate antibiotic prescriptions by studies from Ethiopia and Nigeria.[12,46]

Patient expectations and demand for antibiotics were reported to influence appropriate antibiotic prescription in Cambodia, Uganda, and Nepal. Additional studies from Ethiopia and Nigeria also reported that out-of-pocket

payments by patients influenced prescriber decisions, and prescribers were reported to prescribe antibiotics to satisfy patient expectations.[12,37,43,46,47]

Poor infection prevention and control (IPC) measures in health facilities were also reported to indirectly drive antibiotic overuse, as prescribers turn to prescribe antibiotics that will cover perceived infection risk, as reported in a study from Cambodia by Om et al.[43]

Over-the-counter sale of antibiotics in pharmacies was reported as a barrier to appropriate antibiotic prescription by Krishna et al in a study that was carried out in health facilities in India.[50]

Table 1: Search string by focus area.

Search focus	Search string
Barriers to appropriate antibiotic use	(("antibiotic prescribing" OR "antibiotic prescription") AND ("barriers" OR "factors influencing" OR "challenges" OR "determinants" OR "drivers" OR "obstacles") AND ("rational" OR "appropriate" OR "irrational" OR "inappropriate") AND ("hospitals" OR "humans" OR "clinics"))
Antibiotic prescription use patterns	(("AWaRe" OR "WHO/INRUD prescription indicators") AND ("rational" OR "appropriate") AND ("hospitals" OR "humans" OR "clinics") AND ("antibiotics"))

Table 2: Characteristics of studies included in review and key findings.

S. no.	Author	Title	Country of origin	Objective	Key findings
1	Kihwili et al, 2023[2]	A point prevalence survey of antimicrobial use at Geita Regional Referral Hospital in North-Western Tanzania	Tanzania	To determine the prevalence of antibiotic use at Geita Regional Referral Hospital (GRRH) located along the shores of Lake Victoria in north-western Tanzania	About 94.8% (55/58) patients were on antibiotics with a mean (±SD) prescription of 2 (±0.5) antibiotic agents ranging from 1 to 4 different agents. according to the WHO-AWaRe classification, 50.9%, 23.6%, and 25.5% were under the Access category, Watch category, and not recommended category, respectively. Empiric treatment were the commonest indications for antibiotic use
2	Tirfe et al, 2023[38]	A three years antimicrobials consumption in Ethiopia from 2017 to 2019: A cross-sectional study	Ethiopia	To generate evidence for decision-making on the appropriate use of antimicrobials in Ethiopia and tackle AMR	About 75.83% of the consumed antimicrobials fall under the WHO AWaRe classification and 67.87% of antimicrobial consumption was from the WHO Access class medications, with Watch and Reserve classes accounting for 32.13% and <1%, respectively
3	Djochie et al, 2025[6]	Adherence to WHO/INRUD prescription indicators in public hospitals: evidence from the Ashanti Region, Ghana	Ghana	This study assessed adherence to WHO/INRUD prescribing indicators in public hospitals and determined each hospital's index of rational drug prescribing (IRDP)	Antibiotic prescribing exceeded the <30% target, averaging 60.84%
4	Abu-Ajaleh et al, 2023[40]	An evaluation of the impact of increasing the awareness of the WHO Access, Watch, and Reserve (AWaRe) antibiotics classification on knowledge, attitudes,	Jordan	The study aims to determine the effect of enhancing knowledge and awareness of the WHO Access, Watch, and Reserve (aware) antibiotics classification on hospital clinical staff's knowledge,	This study showed important gaps in knowledge and attitudes towards AWaRe, highlighting the need for increasing the awareness of the AWaRe tool amongst healthcare practitioners to ensure rational use of antibiotics

Continued.

S. no.	Author	Title	Country of origin	Objective	Key findings
		and hospital antibiotic prescribing practices		attitudes and antibiotic prescribing practices	
5	Nepal et al, 2020[29]	Analysis of patterns of antibiotic prescribing in public health facilities in Nepal	Nepal	To examine patterns of antibiotic prescribing in public health facilities in Nepal and explored factors influencing these practices	The antibiotic prescription rate 44.7%, was approximately twice the WHO recommended value (20.0 to 26.8%). The antibiotic prescribing rate for hospital inpatients (64.6%) was higher than for other facilities, with the prescribing rate also high in primary health care centres (50.4%) and health posts (52.2%)
6	Kizito et al, 2025[37]	Antibiotic consumption and utilization at a large tertiary care level hospital in Uganda: a point prevalence survey	Uganda	To describe the consumption and utilization of antibiotics at a large tertiary-level hospital in Uganda	59.6% and 40.3% were respectively from the Access and Watch antibiotic groups while 0.1% of consumed antibiotics were from the reserve group. 46.2% and 45.6% of antibiotics prescribed in outpatient department were from the Access and Watch group of antibiotics respectively, there was no antibiotic prescribed from the Reserve group (0%) while 18.2% were unclassified antibiotics. Of the total prescriptions in inpatient department, 38.3% , 54.3% respectively were from the Access and Watch group while 0.6% were from the Reserve group, and 6.8% were unclassified antibiotics
7	Om et al, 2016[52]	Antibiotic prescribing practices: a national survey of Cambodian physicians	Cambo-dia	To assessed knowledge, attitudes, and practices in regard to antibiotic prescribing and resistance in Cambodian physicians from public hospitals	Limited knowledge on local antibiotic resistance patterns, treatment guidelines were identified as key factors affecting antibiotic prescription
8	Prah et al, 2017[27]	Antibiotic prescription pattern in a Ghanaian primary health care facility	Ghana	To assess the prescription pattern of antibiotics and explored the use of STG by clinicians	There was an antibiotics prescription rate of 55.2%, with amoxicillin and ciprofloxacin being the most commonly used
9	Chizi-mu et al, 2024[22]	Antibiotic use and adherence to the WHO AWaRe guidelines across 16 hospitals in Zambia: a point prevalence survey	Zambia	This study evaluated the prevalence of antibiotic use and adherence to the World Health Organization (WHO) Access, Watch and Reserve (aware) classification of antibiotics across 16 hospitals in Zambia	The overall prevalence of antibiotic use was 70%. Additionally, 52% of the inpatients received Watch group antibiotics, with ceftriaxone being the most prescribed antibiotic. Slightly below half (48%) of the inpatients received Access group antibiotics
10	Lakoh et al, 2023[7]	Antibiotic use and consumption among medical patients of two hospitals in Sierra Leone: a descriptive report.	Sierra Leone	To assess antibiotic use and consumption among medical patients of two hospitals in different geographic regions of Sierra Leone	Regardless of the diagnosis, 94.9% patients received at least one antibiotic. The Access and Watch antibiotics accounted 28.2% and 71.7% respectively of antibiotics prescribed. None of the

Continued.

S. no.	Author	Title	Country of origin	Objective	Key findings
					patients were prescribed a Reserve antibiotic
11	Kalungia et al, 2022[14]	Antibiotic use and stewardship indicators in the first- and second-level hospitals in Zambia: findings and implications for the future	Zambia	To document current prescribing patterns via point prevalence surveys (PPS) alongside recognized indicators to improve future use	The prevalence of antibiotic use among inpatients was 59.0% with ceftriaxone accounting for 36.1% of all empiric prescriptions. High empiric use, frequent prescribing of Watch antibiotics, and limited adherence to treatment guidelines were identified as key challenges to antibiotic prescription
12	Gnimavo et al, 2025[19]	Antibiotic use at the Centre Hospitalier Universitaire de Zone d'Abomey Calavi/Sô-Ava (CHUZ/AS) in Benin: a point prevalence survey	Benin	To evaluated the use of antibiotics using a point prevalence survey at the Centre Hospitalier Universitaire de Zone d'Abomey Calavi/Sô-Ava (CHUZ/AS) in Benin	The prevalence of antibiotic use was 82.9%, with patients receiving 1–5 antibiotics (mean 2.45 ± 1.11; median 2). Beta-lactams (46.7%), aminoglycosides (20.6%), and nitroimidazoles (19.7%) were the most commonly prescribed classes. According to the WHO AWaRe classification, 30.4% received Access antibiotics, 44% received a combination of Access and Watch antibiotics Most of the treatment was empiric with only 22.7% of patients were treated based on culture and sensitivity testing, reflecting a high reliance on empiric therapy and limited microbiological guidance
13	Maina et al, 2020[51]	Antibiotic use in Kenyan public hospitals: prevalence, appropriateness and link to guideline availability	Kenya	To examine prescription patterns and explore to what extent guidelines are available and how they might influence treatment appropriateness among hospitalised patients in Kenyan hospitals	Physical availability of treatment guidelines was identified as a key contributing factor to appropriate antibiotic therapy
14	Darkwah et al, 2021[23]	Assessment of prescribing patterns of antibiotics using National Treatment Guidelines and World Health Organization prescribing indicators at the Ghana Police Hospital: a pilot study	Ghana	To evaluate prescribing pattern of antibiotics at the Ghana Police Hospital using National Standard Treatment Guidelines (STG) and World Health Organization (WHO) prescribing indicators	Prescriptions with antibiotics for outpatients constituted 72.8%, while that for in-patients was 27.2%. The Access group of antibiotics (74%) was the most prescribed, followed by the Watch group (24%). There were no antibiotics prescribed from the Reserve group of antibiotics while 2% of prescribed antibiotics was not part of the AwaRe classification
15	Raja et al, 2021[35]	Assessment of the antibiotics and other drug prescribing patterns in a primary health care setting	India	This study was aimed at assessing the drug prescribing pattern using WHO prescribing indicators at the primary health care level	Antibiotics were prescribed in 32.9% of patient encounters

Continued.

S. no.	Author	Title	Country of origin	Objective	Key findings
16	Ogunleye et al, 2019[46]	Determinants of antibiotic prescribing among doctors in a Nigerian urban tertiary hospital	Nigeria	To investigate the patterns and determinants of antibiotic prescribing among doctors in a tertiary hospital in Nigeria as the first step to improve future antibiotic use in hospitals	Antibiotics are frequently prescribed by of clinicians, primarily based on clinical judgment and experience, with minimal laboratory support. Factors that affected rational antibiotic prescription included cost to patients (as most patients pay out of pocket), drug availability, promotional and marketing activities of pharmaceutical industry, Senior colleague decisions, absent or non-functional institutional antimicrobial policies and guidelines
17	Kakumba et al, 2023[21]	Evaluation of antibiotic prescribing pattern using WHO Access, Watch and Reserve classification in Kinshasa, Democratic Republic of Congo	DR Congo	To explore antibiotic dispensing pattern from health professionals according to the WHO aware classification to strengthen the national antimicrobial resistance plan	399 medical prescriptions were collected from 80 drugstores and among which, 301 (75.25%) contained antibiotics. A total of 463 antibiotics were prescribed and distributed as 36.5% were from the access group, 43.2% from the watch group and 20.3% fixed-dose combinations antibiotics in the not recommended group of antibiotics according to the AWaRe classification
18	Al-Azayzih et al, 2017[36]	Evaluation of drug-prescribing patterns based on the WHO prescribing indicators at outpatient clinics of five hospitals in Jordan: a cross-sectional study	Jordan	To evaluate the trends and issues related to prescription at outpatient hospital pharmacies in Jordan and to contrast that to the WHO rational medication list and WHO drug use indicators	The percentage of encounters which had antibiotics at least one antibiotic prescribed was 17.7%
19	Huong et al, 2020[45]	Factors influencing choices of empirical antibiotic treatment for bacterial infections in a scenario-based survey in Vietnam	Vietnam	To understand doctors' choices of antibiotics for empirical treatment of common bacterial infections and the factors influencing decision-making	Factors that affected rational antibiotic prescribing include both disease-related characteristics and individual factors, including acceptable minimum treatment coverage. Factors identified to influence antibiotic choice included what prescribers believed the drug could treat (perceived risk) and the minimum level of effectiveness they considered acceptable for starting treatment without lab confirmation
20	Nepal et al, 2021[47]	Factors influencing the inappropriate use of antibiotics in the Rupandehi district of Nepal	Nepal	To identify the perception of service providers and policymakers about the inappropriate use of antibiotics in Nepal	Limited consumer knowledge and financial constraints led to self-medication and pressure on providers to prescribe antibiotics. Inadequate antibiotic availability and lack of diagnostic facilities also contributed to inappropriate use, while in the private sector,

Continued.

S. no.	Author	Title	Country of origin	Objective	Key findings
					profit motives and pharmaceutical incentives further encouraged inappropriate prescribing and dispensing
21	Ampo-nsah et al, 2022[32]	High levels of outpatient antibiotic prescription at a district hospital in Ghana: results of a cross sectional study	Ghana	To monitor antibiotic prescription practice	Antibiotics were prescribed in over 36% of patient encounters, consistently exceeding the WHO-recommended level of 27%. Nearly half of the prescribed antibiotics were from the WHO Watch group
22	Moham-med et al, 2020[48]	Identifying opportunities for antimicrobial stewardship through a point prevalence survey in an Indian tertiary-care teaching hospital	India	To report an audit of antimicrobial use patterns in a tertiary-care teaching hospital in order to identify opportunities for antimicrobial stewardship	There was high empirical antibiotic use, poor transition from empirical to rational use, and underutilisation of microbiological tests were noted as key challenges to antibiotic prescription
23	Sheikh et al, 2024[20]	Identifying targets for antibiotic stewardship interventions in pediatric patients in Punjab, Pakistan: point prevalence surveys using AWaRe guidance	Pakistan	To assess the patterns of antibiotic use in pediatric patients across Punjab, Pakistan, employing the WHO AWaRe classification to pinpoint targets for intervention and encourage rational antibiotic usage	Out of 498 pediatric patients, 409 were receiving antibiotics, representing an antibiotic use prevalence of 82.1%. A substantial majority (72.1%) of the prescribed antibiotics fell under the WHO's Watch category, with 25.7% in the Access category and 2.2% in the Reserve group
24	Om et al, 2016[43]	If it's a broad spectrum, it can shoot better": inappropriate antibiotic prescribing in Cambodia	Cambo-dia	To explore the drivers of inappropriate antibiotic prescribing	Inappropriate antibiotic prescribing was a common practice and driven by seven factors: Empirical prescribing habit, limited diagnostic capacity, lack of microbiology evidence, non-evidence-based clinical guidelines, perceived patient demand, poor hygiene and infection control, and perceived bacterial resistance to narrow-spectrum antibiotics
25	Chansa-mouth et al, 2024[53]	Implementing the WHO AWaRe antibiotic book guidance in lower-resource settings: the case of the Lao PDR	Laos	To review the AWaRe antibiotic book from the perspective of implementation in low-resource settings, using the Lao PDR (Laos) as a case study	Access to antibiotics is challenging in low-resource settings in terms of unavailability in the country (low demand or small market size), patchy access, especially for those living in remote areas, and unaffordability
26	Adjei et al, 2023[49]	Impact of point-of-care rapid diagnostic tests on antibiotic prescription among patients aged <18 years in primary healthcare settings in 2 peri-urban districts in Ghana: randomized controlled trial results	Ghana	To assess the impact of diagnostic algorithms incorporating rapid diagnostic tests on clinical outcomes and antibiotic prescriptions compared with standard-of-care practices, of acute febrile illness cases at outpatient clinics in Shai-Osudoku	Inadequate access to Point-of-care diagnostics is a contributing factor to inappropriate antibiotic prescription in primary healthcare

Continued.

S. no.	Author	Title	Country of origin	Objective	Key findings
				and Prampram districts in Ghana	
27	Hadley et al, 2019[54]	Is 'Health for All' synonymous with 'antibiotics for all': changes in antibiotic prescribing in a performance-based financing pilot in Zanzibar	Tanzania	To evaluate the impact of a performance-based financing (PBF) program that incorporated direct quality indicators and financial incentives on the appropriateness of antibiotic prescribing and adherence to treatment guidelines in primary health care facilities in Zanzibar	The absence of continuous monitoring and motivation among prescribers is a critical challenge affecting rational antibiotic therapy
28	Ashraf et al, 2022[41]	Knowledge, attitude, and practice of clinicians about antimicrobial stewardship and resistance among hospitals of Pakistan: a multicenter cross-sectional study	Pakistan	To highlight gaps in antimicrobial stewardship and AMR among practicing doctors working in public tertiary care teaching hospitals of Lahore, Pakistan	Limited knowledge regarding the antimicrobial spectrum of activity for specific infections is a key factor that affects antibiotic prescription
29	Abdou et al, 2025[18]	Over-prescription of Watch antibiotics in primary healthcare settings in Sudan: results from routinely collected prescription data	Sudan	This study aims to examine the patterns of antibiotic prescription in primary healthcare settings (PHC) in Sudan and its compliance to the World Health Organization (WHO) Access, Watch and Reserve (aware) antibiotic book	There was an antibiotic prescription rate of 84.1%. Among these, 29.0% belonged to the Access group, while the majority, 71.0%, were from the Watch group. Notably, no antibiotics from the Reserve group were prescribed
30	Iliyasu et al, 2015[28]	Pattern of antibiotic prescription and resistance profile of common bacterial isolates in the internal medicine wards of a tertiary referral centre in Nigeria	Nigeria	This study examined the pattern of antibiotic prescription in a tertiary hospital in Nigeria	The antibiotic prescription rate at the internal medicine ward was 49.0%. ceftriaxone (39.5%) was the most commonly prescribed antibiotic
31	Allwell-Brown et al, 2022[24]	Patterns and contextual determinants of antibiotic prescribing for febrile under-five outpatients at primary and secondary healthcare facilities in Bugisu, Eastern Uganda	Uganda	To describe patterns and contextual determinants of antibiotic prescribing for febrile under-five outpatients at primary and secondary healthcare facilities across Bugisu, Eastern Uganda	Antibiotics were prescribed for 62.2% of 3471 febrile under-five outpatients
32	Krishna et al, 2018[50]	Perception of health-care staff's knowledge, attitudes, and practices and of potential barriers toward containing antibiotic resistance in public	India	Evaluated the knowledge, attitude, practices, and barriers around antibiotic usage and resistance among the government healthcare staff	Only 38% of prescribers sought microbiologist's input for antibiotic recommendations. Unavailability of antibiotics was quoted a major barrier to practice (78%), followed by unregulated

Continued.

S. no.	Author	Title	Country of origin	Objective	Key findings
		health-care facilities of Tumkur district (South India)			over the counter sale (62%) and high work load (56.6)
33	Sumon et al, 2024[44]	Perceptions of antibiotic stewardship programs and determinants of antibiotic prescribing patterns among physicians in tertiary hospitals in Bangladesh: implications for future policy and practice	Bangla-desh	To investigate the awareness, perceptions, and practices of physicians regarding asps, AMR, and antibiotic prescribing in tertiary care hospitals in Bangladesh	The empirical use of broad-spectrum antibiotics, delayed laboratory results and the existence of drug-resistant patients were identified as key contributors to inappropriate antibiotic prescription
34	Fowota -de et al, 2020[26]	Point prevalence survey of antimicrobial prescribing in a Nigerian Hospital: findings and implications on antimicrobial resistance	Nigeria	A standardized method for surveillance of antimicrobial use in hospitals was employed to assess the antimicrobial prescribing practices in UCH, Ibadan, Nigeria	There as an antibiotic prescription rate of 59.6% per patient encounter
35	Kamita et al, 2022[25]	Point prevalence survey to assess antibiotic prescribing pattern among hospitalized patients in a county referral hospital in Kenya	Kenya	This study examined the antibiotic prescription patterns among hospitalized patients at the Kiambu Level 5 hospital to find potential for hospital quality improvement	Among 308 surveyed patients, 191 (62%) received antibiotics. According to the AWaRe classification, 57% of prescribed antibiotics were from the Access group and 42% from the Watch group
36	Delfos-se et al, 2025[34]	Point-prevalence survey of antimicrobial use in Benin hospitals: the need for antimicrobial stewardship programs	Benin	The study aimed to assess antimicrobial use, and prescribing patterns in two public hospitals through a point-prevalence survey	Antibiotic prescription rate of 32.9% was reported. According to the WHO AWaRe classification system, the most prescribed antibiotic belonged to the Access group (64%) with 32% Watch, 0 % from reserve, 2.6 not recommended and 0.5 not rated
37	Karas-neh et al, 2021[42]	Prescribers' knowledge, attitudes and behaviours on antibiotics, antibiotic use and antibiotic resistance in Jordan	Jordan	This study aimed at evaluating prescribers' knowledge, attitudes and behaviours about antibiotic use and antibiotic resistance	Prescriber knowledge on effective use, unnecessary use or associated side effects of antibiotics was high (>90%), compared with their knowledge on the spread of antibiotic resistance (62.2%)
38	Dereje et al, 2023[33]	Prescribing pattern and associated factors in community pharmacies: a cross-sectional study using AWaRe classification and WHO antibiotic prescribing indicators in Dire Dawa, Ethiopia	Ethiopia	To evaluate the prescribing patterns using AWaRe classification and WHO prescribing indicators with their associated factors in a cross-sectional design at Dire Dawa, Ethiopia	Antibiotics were included in 47.8% of encounters, while 43.1% were prescribed from the Watch groups while 55.3% of antibiotics were prescribed from the Access group
39	Chem et al, 2018[31]	Prescribing patterns and associated factors of antibiotic prescription in primary health care facilities of Kumbo East and	Came-roon	To Investigate prescribing patterns and predictors of antibiotic prescription in primary health care facilities in Kumbo East and Kumbo West health	Overall antibiotic prescription rate was 36.71%, with a mean of 1.14 antibiotics prescribed per patient. Amoxicillin was the most prescribed (29.9%). All antibiotics prescribed were broad-spectrum.

Continued.

S. no.	Author	Title	Country of origin	Objective	Key findings
		Kumbo West Health Districts, North West Cameroon		districts in North West Cameroon	Antibiotics were prescribed for patients with malaria and also in situations where diagnosis was uncertain
40	Altaye et al, 2024[12]	Qualitative enquiry on factors affecting antibiotic prescribing at primary healthcare facilities in Addis Ababa, Ethiopia	Ethiopia	This study aimed to explore factors affecting antibiotic prescribing at primary healthcare facilities in Addis Ababa, Ethiopia	Prescribers' antibiotic decisions were influenced by multiple factors. Prescriber-related factors included lack of knowledge about antibiotic use and resistance, failure to review patient history, not considering resistance concerns when prescribing, and competency gaps. System-related factors included shortages of antibiotics and laboratory reagents, limited access to updated antimicrobial resistance data, high patient load, inadequate capacity, private sector practices, insufficient follow-up and support, and out of pocket payments
41	Kizito et al, 2024[13]	Some patients demand for a prescription of an antibiotic': an assessment of barriers and facilitators to rational antimicrobial use in a private health facility in Uganda	Uganda	To describe factors influencing antimicrobial prescription at a large tertiary care private not-for-profit hospital in Uganda	Antibiotics were often prescribed irrationally, influenced by previous experience using antibiotics, fear of bad outcomes, patient demand and expectations, influence from senior colleagues, the turnaround time of clinical investigations, and drug marketers were the barriers and facilitators to antimicrobial prescription. Prescribers highlighted the need for updated clinical guidelines, hospital antibiograms, and continuous education to promote rational antimicrobial use
42	Chans-amouth et al, 2024[39]	Understanding hospital antimicrobial prescribing decisions and determinants of uptake of new local antimicrobial prescribing guidelines in Laos	Laos	This study explored the determinants of antibiotic prescribing decisions and how the new prescribing guidelines were being used	Lack of certain antibiotics and turnaround times of laboratory results were the main challenges to prescribing antibiotics appropriately. Improving antibiotic knowledge was the most common recommendation in order to improve the appropriate use of antibiotics
43	Costan-tine et al, 2023[17]	WHO/INRUD prescribing indicators among tertiary regional referral hospitals in Dar es Salaam, Tanzania: A call to strengthen antibiotic stewardship programmes	Tanzania	This study aimed to determine antibiotic prescribing patterns in tertiary hospitals in Dar es Salaam, Tanzania	About 88.0% of the prescriptions contained antibiotics (optimal: 20.0-26.8%)
44	Hailesi-lase et al, 2024[30]	WHO/INRUD prescribing indicators with a focus on antibiotics utilization	Ethiopia	This study aimed to evaluate the prescribing patterns in Adigrat General Hospital, Tigrai, Ethiopia	There was an antibiotic prescription rate of 44.5%. 54.4% and 45.6% of the total antibiotics prescribed were from

Continued.

S. no.	Author	Title	Country of origin	Objective	Key findings
		patterns at outpatient department of Adigrat general hospital, Tigrai, Ethiopia: a retrospective cross-sectional study			Access and Watch groups antibiotics respectively

Table 3: Barriers to appropriate antibiotic prescription in studies included in the scoping review.

Barriers	Abu-Ajaleh et al, 2023	Adjei et al, 2023	Altaye et al, 2024	Ashraf et al, 2022	Chansamouth et al, 2024	Chansamouth et al, 2024	Chem et al, 2018	Hadley et al, 2019	Huong et al, 2020	Kalungia et al, 2022	Karasneh et al, 2021	Kizito et al, 2024	Krishna et al, 2018	Maina et al, 2020	Mohammed et al, 2020	Nepal et al, 2021	Ogunleye et al, 2019	Om et al, 2016	Om et al, 2016	Sumon et al, 2024
Prescriber knowledge and attitudes	R		R	R		R	R		R		R	R		R			R		R	R
Inadequate access to diagnostics		R	R			R							R		R	R	R		R	R
Limited access to guidelines			R							R		R		R			R	R	R	
Inadequate access to antibiotics			R		R	R							R			R	R			
Inadequate monitoring and support systems			R					R					R							
Financial incentives from pharmaceu-tical companies												R				R	R			
High workload			R										R							
Out of pocket payments			R														R			
Patient expectations and demand																R				
Poor IPC measures																			R	
Over the counter sale													R							

R indicates that the barrier was identified in the corresponding study; blank indicates that the barrier was not reported in the corresponding study.

DISCUSSION

This scoping review synthesized evidence from 44 studies across LMICs on antibiotic prescription patterns structured around WHO/INRUD prescribing indicators, and the WHO AWaRe classification, and also assessed barriers to appropriate antibiotic prescription.

Studies in this review showed that the proportion of patient encounters prescribed at least one antibiotic was well above the WHO recommended optimal range of 20-26.8%. These findings are consistent with earlier reviews that reported high antibiotic prescribing rates in similar settings, such as a review of studies from Eastern Africa, which showed that the average antibiotic prescription rate per patient encounter was 57%, surpassing the standard put in place by the WHO.[55] The WHO AWaRe classification analysis further underscores suboptimal prescribing behaviors. Most studies reported the prescription rate of Access category antibiotics to be below the recommended threshold ≥60% by WHO, with a disproportionate reliance on Watch antibiotics. This trend is concerning, as Watch antibiotics are more prone to resistance development and are intended for more targeted, high-risk situations.[10]

The low prescription of reserve antibiotics aligns with their restricted availability and stewardship policies, but the observed prescription of non-recommended antibiotic combinations at high percentages of about 20% in countries like Tanzania and the Democratic Republic of Congo suggests gaps in guideline adherence and regulatory enforcement.[2,21] These patterns in antibiotics used according to the AWaRe classification suggest substantial gaps in appropriate antibiotic prescription. While access antibiotics should constitute at least 60% of total antibiotics prescribed, many studies in health facilities failed to meet this benchmark. This finding is in line with a global point prevalence survey that was carried out in 69 countries, which highlighted the overuse of Watch antibiotics.[1]

Our synthesis of evidence on barriers to appropriate antibiotic prescription in healthcare facilities in LMICs identified recurring themes across studies. Prescribers' knowledge and attitudes were identified among the major barriers to appropriate antibiotic prescription in this review. This finding is in line with a review by Davari et al that identified the knowledge and attitude of prescribers as barriers to appropriate antibiotic prescription.[4] Inadequate access to diagnostics was also identified as one of the main barriers to appropriate antibiotic prescription in this setting. This finding is in line with other reviews, such as that reported by Harun et al as well as findings from the Mapping AMR and AMU Partnership (MAAP) project, where only 1.3% of 50,000 medical laboratories across 14 African countries were engaged in bacteriological testing.[56,57] Poor access to diagnostics, including culture and sensitivity testing are a critical driver for over prescription of Watch antibiotics.[44] Diagnostics are essential in mitigating inappropriate antibiotic prescription, as they allow healthcare professionals to identify the most suitable treatment for specific conditions, thereby minimizing the overuse of antibiotics, which is a driver of antibiotic resistance.[57] In LMICs, access to diagnostics is primarily centralized, with the test only being accessed at specialized laboratories with limited access for local healthcare facilities, thereby posing challenges for the healthcare system and the patients it serves.[57] Another key barrier to appropriate antibiotic prescription identified was inadequate access to treatment guidelines. This is in line with a review on LMICs by Harun et al which identified adequate access to treatment guidelines as a key contributing factor to appropriate antibiotic prescription.[56] The findings from this review further align with broader antimicrobial stewardship literature, which emphasizes the role of treatment guidelines in appropriate antibiotic prescription.[9] Additional factors such as poor access to antibiotics was identified as another important barrier to appropriate antibiotic prescription. This finding is consistent with a review by Saleem et al in LMICs, where poor access to antibiotics was identified as a key barrier to appropriate antibiotic prescription.[58] Limited access to antibiotics reduces prescribers' ability to adhere to treatment guidelines and contributes to the use of alternative or non-recommended antibiotic options.[58]

Limitations

This review has some limitations. First, although a comprehensive search was conducted, the review was limited to English language studies indexed in Scopus, Pubmed or both. Relevant evidence from unpublished or grey literature, as well as studies published in other databases or languages, may therefore have been missed.

CONCLUSION

This scoping review highlights that inappropriate antibiotic prescribing is widespread in LMICs, with prescription rates often exceeding WHO recommendations and access antibiotic use frequently falling short of global targets. Watch antibiotics prescription dominate many hospital settings, and empiric prescribing remains the norm due to poor access to diagnostics. This scoping review identified consistent and interrelated barriers to appropriate antibiotic prescribing in healthcare facilities across LMICs, with prescriber knowledge and attitudes, inadequate access to diagnostics, limited availability of treatment guidelines, and poor access to antibiotics emerging as key barriers.

These barriers were frequently reported across studies and are supported by evidence from regional and global reviews, highlighting their persistence across diverse LMIC settings. Overall, the findings suggest that inappropriate antibiotic prescribing in LMIC healthcare settings is largely influenced by a combination of prescriber-related and health system factors. These findings highlight the need for integrated antimicrobial stewardship interventions that address both behavioral and structural determinants of antibiotic prescribing practices.

Recommendations

The findings from this review shows that there is an urgent need to implement multifaceted antimicrobial stewardship programs (ASPs) tailored to LMIC realities. Effective strategies should include: **s**trengthening diagnostic capacity through the provision of affordable microbiology services and rapid diagnostics, establishing targeted policies that promote sustainable and equitable access to antimicrobials, developing, updating, and disseminating national and facility-level treatment guidelines and embedding them into clinical decision support systems, addressing behavioral drivers of inappropriate antibiotic prescription via continuous professional education and mentorship programs, developing structured systems to monitor and evaluate antibiotic prescription practices in these settings, and strengthening community engagement initiatives to reduce inappropriate patient demand for antibiotics and improving public awareness of AMR.

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REFERENCES

1. Pauwels I, Versporten A, Drapier N, Vlieghe E, Goossens H, the Global-PPS network. Hospital antibiotic prescribing patterns in adult patients according to the WHO Access, Watch and Reserve classification (AWaRe): results from a worldwide point prevalence survey in 69 countries. J Antimicrob Chemother. 2021;76(6):1614-24.
2. Kihwili L, Silago V, Francis EN, Idahya VA, Saguda ZC, Mapunjo S, et al. A Point Prevalence Survey of Antimicrobial Use at Geita Regional Referral Hospital in North-Western Tanzania. Pharm Basel Switz. 2023;11(5).
3. Byrne MK, Miellet S, McGlinn A, Fish J, Meedya S, Reynolds N, et al. The drivers of antibiotic use and misuse: the development and investigation of a theory driven community measure. BMC Public Health. 2019;19(1):1425.
4. Davari M, Khorasani E, Tigabu BM. Factors Influencing Prescribing Decisions of Physicians: A Review. Ethiop J Health Sci. 2018;28(6):6.
5. Murray CJ, Ikuta KS, Sharara F, Swetschinski L, Aguilar GR, Gray A, et al. Global burden of bacterial antimicrobial resistance in 2019: a systematic analysis. The Lancet. 2022;399(10325):629-55.
6. Djochie RDA, Owusu-Donkor R, d'Almeida EM, Gyamfi Akwah FK, Kyeremateng E, Opoku-Afriyie S, et al. Adherence to WHO/INRUD prescription indicators in public hospitals: evidence from the Ashanti Region, Ghana. Ther Adv Drug Saf. 2025;16:20420986251346321.
7. Lakoh S, Williams CEE, Sevalie S, Russell JBW, Conteh SK, Kanu JS, et al. Antibiotic use and consumption among medical patients of two hospitals in Sierra Leone: a descriptive report. BMC Infect Dis. 2023;23(1):737.
8. Kilipamwambu A, Bwire GM, Myemba DT, Njiro BJ, Majigo MV. WHO/INRUD core prescribing indicators and antibiotic utilization patterns among primary health care facilities in Ilala district, Tanzania. JAC-Antimicrob Resist. 2021;3(2):dlab049.
9. Zanichelli V, Sharland M, Cappello B, Moja L, Getahun H, Pessoa-Silva C, et al. The WHO AWaRe (Access, Watch, Reserve) antibiotic book and prevention of antimicrobial resistance. Bull World Health Organ. 2023;101(4):290-6.
10. World Health Organization. WHO access, watch, reserve (AWaRe) classification of antibiotics for evaluation and monitoring of use, 2021. 2021. Available at: https://iris.who.int/handle/10665/345555. Accessed on 15 May 2026.
11. United Nations. UN General Assembly high-level meeting on antimicrobial resistance. 2024. Available at: https://www.un.org/pga/wp-content/uploads/sites/108/2024/09/FINAL-Text-AMR-to-PGA.pdf. Accessed on 15 May 2026.
12. Altaye FW, Thupayagale-Tshweneagae G, Mfidi FH. Qualitative enquiry on factors affecting antibiotic prescribing at primary healthcare facilities in Addis Ababa, Ethiopia. Front Med. 2024;8:11.
13. Kizito M, Lalitha R, Kajumbula H, Muhumuza R, Kintu MG, Muyanja D, et al. 'Some patients demand for a prescription of an antibiotic': an assessment of barriers and facilitators to rational antimicrobial use in a private health facility in Uganda. JAC-Antimicrob Resist. 2024;6(6).
14. Kalungia AC, Mukosha M, Mwila C, Banda D, Mwale M, Kagulura S, et al. Antibiotic Use and Stewardship Indicators in the First- and Second-Level Hospitals in Zambia: Findings and Implications for the Future. Antibiot Basel Switz. 2022;11(11).
15. Tricco AC, Lillie E, Zarin W, O'Brien KK, Colquhoun H, Levac D, et al. PRISMA Extension for Scoping Reviews (PRISMA-ScR): Checklist and Explanation. Ann Intern Med. 2018;169(7):467-73.
16. The World Bank. World Bank Country and Lending Groups – World Bank Data Help Desk. 2025. Available at: https://datahelpdesk.worldbank.org/knowledgebase/articles/906519-world-bank-country-and-lending-groups. Accessed on 15 May 2026.
17. Costantine JK, Bwire GM, Myemba DT, Sambayi G, Njiro BJ, Kilipamwambu A, et al. WHO/INRUD prescribing indicators among tertiary regional referral hospitals in Dar es Salaam, Tanzania: a call to strengthen antibiotic stewardship programmes. JAC-Antimicrob Resist. 2023;5(4):dlad093.
18. Abdou E, Hayder R, Salaheldin M, Eltayeb E. Over-prescription of Watch antibiotics in primary healthcare settings in Sudan: results from routinely collected prescription data. J Infect Dev Ctries. 2025;19(1):91-7.
19. Gnimavo MS, Boya B, Mudenda S, Allabi AC. Antibiotic use at the Centre Hospitalier Universitaire de Zone d'Abomey Calavi/Sô-Ava (CHUZ/AS) in Benin: a point prevalence survey. JAC-Antimicrob Resist. 2025;7(1):dlae220.
20. Sheikh S, Saleem Z, Afzal S, Qamar MU, Raza AA, Haider Naqvi SZ, et al. Identifying targets for antibiotic stewardship interventions in pediatric

patients in Punjab, Pakistan: point prevalence surveys using AWaRe guidance. Front Pediatr. 2024;12:1469766.
21. Kakumba JM, Kindenge JM, Kapepula PM, Iyamba JML, Mashi ML, Mulwahali JW, et al. Evaluation of Antibiotic Prescribing Pattern Using WHO Access, Watch and Reserve Classification in Kinshasa, Democratic Republic of Congo. Antibiotics. 2023;12(8):8.
22. Chizimu JY, Mudenda S, Yamba K, Lukwesa C, Chanda R, Nakazwe R, et al. Antibiotic use and adherence to the WHO AWaRe guidelines across 16 hospitals in Zambia: a point prevalence survey. JAC-Antimicrob Resist. 2024;6(5):dlae170.
23. Darkwah TO, Afriyie DK, Sneddon J, Cockburn A, Opare-Addo MNA, Tagoe B, et al. Assessment of prescribing patterns of antibiotics using National Treatment Guidelines and World Health Organization prescribing indicators at the Ghana Police Hospital: a pilot study. Pan Afr Med J. 2021;39:222.
24. Allwell-Brown G, Namugambe JS, Ssanyu JN, Johansson EW, Hussain-Alkhateeb L, Strömdahl S, et al. Patterns and contextual determinants of antibiotic prescribing for febrile under-five outpatients at primary and secondary healthcare facilities in Bugisu, Eastern Uganda. JAC-Antimicrob Resist. 2022;4(5).
25. Kamita M, Maina M, Kimani R, Mwangi R, Mureithi D, Nduta C, et al. Point prevalence survey to assess antibiotic prescribing pattern among hospitalized patients in a county referral hospital in Kenya. Front Antibiot. 2022;1:993271.
26. Fowotade A, Fasuyi T, Aigbovo O, Versporten A, Adekanmbi O, Akinyemi O, et al. Point Prevalence Survey of Antimicrobial Prescribing in a Nigerian Hospital: Findings and Implications on Antimicrobial Resistance. West Afr J Med. 2020;37(3):216-20.
27. Prah J, Kizzie-Hayford J, Walker E, Ampofo-Asiama A. Antibiotic prescription pattern in a Ghanaian primary health care facility. Pan Afr Med J. 2017;28.
28. Iliyasu G, Dayyab FM, Bolaji TA, Habib ZG, Takwashe IM, Habib AG. Pattern of antibiotic prescription and resistance profile of common bacterial isolates in the internal medicine wards of a tertiary referral centre in Nigeria. J Glob Antimicrob Resist. 2015;3(2):91-4.
29. Nepal A, Hendrie D, Robinson S, Selvey LA. Analysis of patterns of antibiotic prescribing in public health facilities in Nepal. J Infect Dev Ctries. 2020;14(1):18-27.
30. Hailesilase GG, Welegebrial BG, Weres MG, Gebrewahd SA. WHO/INRUD prescribing indicators with a focus on antibiotics utilization patterns at outpatient department of Adigrat general hospital, Tigrai, Ethiopia: a retrospective cross-sectional study. Antimicrob Resist Infect Control. 2024;13(1):133.
31. Chem ED, Anong DN, Akoachere JFKT. Prescribing patterns and associated factors of antibiotic prescription in primary health care facilities of Kumbo East and Kumbo West Health Districts, North West Cameroon. PLoS ONE. 2018;13(3):e0193353.
32. Amponsah OKO, Nagaraja SB, Ayisi-Boateng NK, Nair D, Muradyan K, Asense PS, et al. High Levels of Outpatient Antibiotic Prescription at a District Hospital in Ghana: Results of a Cross Sectional Study. Int J Environ Res Public Health. 2022;19(16).
33. Dereje B, Workneh A, Megersa A, Yibabie S. Prescribing Pattern and Associated Factors in Community Pharmacies: A Cross-Sectional Study Using AWaRe Classification and WHO Antibiotic Prescribing Indicators in Dire Dawa, Ethiopia. Drugs - Real World Outcomes. 2023;10(3):459-69.
34. Delfosse S, Yehouenou CL, Dohou A, Fiogbe DA, Dalleur O. Point-Prevalence Survey of Antimicrobial Use in Benin Hospitals: The Need for Antimicrobial Stewardship Programs. Antibiot Basel Switz. 2025;14(6).
35. Raja D, Sasithra S. Assessment of the Antibiotics and Other Drug Prescribing Patterns in a Primary Health Care Setting. J Commun Dis. 2021;53(4):70-5.
36. Al-Azayzih A, Al-Azzam SI, Alzoubi KH, Shawaqfeh M, Masadeh MM. Evaluation of drug-prescribing patterns based on the WHO prescribing indicators at outpatient clinics of five hospitals in Jordan: A cross-sectional study. Int J Clin Pharmacol Ther. 2017;55(5):425-32.
37. Kizito M, Owachi D, Lule F, Jung L, Bazanye V, Mugerwa I, et al. Antibiotic consumption and utilization at a large tertiary care level hospital in Uganda: A point prevalence survey. PloS One. 2025;20(1):e0313587.
38. Tirfe M, Alemu A, Alemu W, Woldearegay M, Asfaw G, Gerba H, et al. A three years antimicrobials consumption in Ethiopia from 2017 to 2019: A cross-sectional study. PLoS One. 2023;18:4.
39. Chansamouth V, Douangnouvong A, Thammavongsa P, Sombandith X, Keomany S, Rattana S, et al. Understanding hospital antimicrobial prescribing decisions and determinants of uptake of new local antimicrobial prescribing guidelines in Laos. Wellcome Open Res. 2024;9:183.
40. Abu-Ajaleh S, Darwish Elhajji F, Al-Bsoul S, Abu Farha R, Al-Hammouri F, Amer A, et al. An Evaluation of the Impact of Increasing the Awareness of the WHO Access, Watch, and Reserve (AWaRe) Antibiotics Classification on Knowledge, Attitudes, and Hospital Antibiotic Prescribing Practices. Antibiotics. 2023;12(6).
41. Ashraf S, Ashraf S, Ashraf M, Imran MA, Choudhary ZA, Hafsa HT, et al. Knowledge, attitude, and practice of clinicians about antimicrobial stewardship and resistance among hospitals of Pakistan: a multicenter cross-sectional study. Environ Sci Pollut Res Int. 2022;29(6):8382-92.
42. Karasneh RA, Al-Azzam SI, Ababneh M, Al-Azzeh O, Al-Batayneh OB, Muflih SM, et al. Prescribers' knowledge, attitudes and behaviors on antibiotics,

antibiotic use and antibiotic resistance in jordan. Antibiotics. 2021;10(7).
43. Om C, Daily F, Vlieghe E, McLaughlin JC, McLaws ML. "If it's a broad spectrum, it can shoot better": inappropriate antibiotic prescribing in Cambodia. Antimicrob Resist Infect Control. 2016;5:58.
44. Sumon SA, Anwar MMU, Akther FM, Priyanka AS, Tamanna T, Rahman A, et al. Perceptions of antibiotic stewardship programmes and determinants of antibiotic prescribing patterns among physicians in tertiary hospitals in Bangladesh: implications for future policy and practice. J Hosp Infect. 2024;144:56-65.
45. Huong VTL, Dat VQ, Long HB, Tu NTC, Ngan TTD, Nadjm B, et al. Factors influencing choices of empirical antibiotic treatment for bacterial infections in a scenario-based survey in Vietnam. JAC-Antimicrob Resist. 2020;2(4).
46. Ogunleye OO, Fadare JO, Yinka-Ogunleye AF, Anand Paramadhas BD, Godman B. Determinants of antibiotic prescribing among doctors in a Nigerian urban tertiary hospital. Hosp Pract 1995. 2019;47(1):53-8.
47. Nepal A, Hendrie D, Selvey LA, Robinson S. Factors influencing the inappropriate use of antibiotics in the Rupandehi district of Nepal. Int J Health Plann Manage. 2021;36(1):42-59.
48. Mohammed ZA, Mukhopadhyay C, Varma M, Kalwaje Eshwara V. Identifying opportunities for antimicrobial stewardship through a point prevalence survey in an Indian tertiary-care teaching hospital. J Glob Antimicrob Resist. 2020;23:315-20.
49. Adjei A, Kukula V, Narh CT, Odopey S, Arthur E, Odonkor G, et al. Impact of Point-of-Care Rapid Diagnostic Tests on Antibiotic Prescription Among Patients Aged <18 Years in Primary Healthcare Settings in 2 Peri-Urban Districts in Ghana: Randomized Controlled Trial Results. Clin Infect Dis. 2023;77:S145-55.
50. Krishna S, Vlieghe E, Prashanth N, Prakash B, Shahabuddin A, Rukmini V. Perception of health-care staff's knowledge, attitudes, and practices and of potential barriers toward containing antibiotic resistance in public health-care facilities of Tumkur district (South India). Ann Trop Med Public Health. 2018;11(1):23-31.
51. Maina M, Mwaniki P, Odira E, Kiko N, McKnight J, Schultsz C, et al. Antibiotic use in Kenyan public hospitals: Prevalence, appropriateness and link to guideline availability. Int J Infect Dis. 2020;99:10-8.
52. Om C, Vlieghe E, McLaughlin JC, Daily F, McLaws ML. Antibiotic prescribing practices: A national survey of Cambodian physicians. Am J Infect Control. 2016;44(10):1144-8.
53. Chansamouth V, Inlorkham P, Keohavong B, Bellingham K, van Doorn HR, Mayxay M, et al. Implementing the WHO AWaRe antibiotic book guidance in lower-resource settings: the case of the Lao PDR. JAC-Antimicrob Resist. 2024;6(1).
54. Hadley MB, Beard J. Is "Health for All" synonymous with "antibiotics for all": changes in antibiotic prescribing in a performance-based financing pilot in Zanzibar. Health Policy Plan. 2019;34(2):ii28-35.
55. Acam J, Kuodi P, Medhin G, Makonnen E. Antimicrobial prescription patterns in East Africa: a systematic review. Syst Rev. 2023;12(1):18.
56. Harun MGD, Sumon SA, Hasan I, Akther FM, Islam MS, Anwar MMU. Barriers, facilitators, perceptions and impact of interventions in implementing antimicrobial stewardship programs in hospitals of low-middle and middle countries: a scoping review. Antimicrob Resist Infect Control. 2024;13(1):8.
57. African Society for Laboratory Medicine (ASLM). Mapping Antimicrobial Resistance and Antimicrobial Use Partnership (MAAP) project Country Reports. Available at: https://aslm.org/what-we-do/maap/maap-country-reports/. Accessed on 15 May 2026.
58. Saleem Z, Mekonnen BA, Orubu ES, Islam MA, Nguyen TTP, Ubaka CM, et al. Current access, availability and use of antibiotics in primary care among key low- and middle-income countries and the policy implications. Expert Rev Anti Infect Ther. 2026;24(6):545-86.

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