RESEARCH PAPER

AWaRe-Based Evaluation of Cephalosporins Prescribing in General Wards: A Review

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ABSTRACT

Background

Cephalosporins represent one of the main antibiotic types that are highly prescribed in hospital wards worldwide. According to WHO AWaRe classification, second and third-generation Cephalosporins belong to the Watch group, which is a category of drugs that should be used very rarely and their use should be tracked carefully due to their established capability to lead to antimicrobial resistance (AMR). However, general ward prescribing audits hardly ever use the AWaRe framework for evaluating Cephalosporin use, thus resulting in a significant blind spot to stewardship surveillance within the institutions. The misuse of these drugs through prescribing them empirically without microbiological justification, giving undue long courses and prescribing them for wrong indications have massively contributed to the worldwide problem of antibiotic resistance, ESBL emergence, and hospital treatment failure.

Objective

The main aim of this paper is to examine Cephalosporin prescribing in the general wards of tertiary care hospitals through the WHO AWaRe classification framework, measure the level of Watch-category overuse and find the stewardship gaps which structurally support it.

Methodology

A comprehensive literature search was conducted across the PubMed/MEDLINE, Scopus, and Google Scholar databases to evaluate Cephalosporin prescribing practices. The search strategy was to use keywords tailored to identify rational use, stewardship boundaries, adherence trends and AWaRe based prescribing in general wards.

Results

The Watch category Cephalosporins especially ceftriaxone were the main drugs prescribed in general wards. The percentage of Access antibiotics in almost all the institutions surveyed was very low as compared to 60% level recommended by the WHO. In most of the studies, only about 22% of patients admitted to hospitals did not receive antibiotic treatment which was majorly made up of Watch-category drugs in all wards. Almost all the studies reported empirical prescribing without microbiological support and the level of awareness of the AWaRe classification among medical prescribers was very low in all the settings.

Conclusion

Prescribing of Cephalosporins almost exclusively from the Watch category in general wards of institutional settings is highly disproportionate to the WHO stewardship target and requires an immediate remedial response. Conducting prescribing audits based on the AWaRe system regularly, making it a rule to get microbiological testing done before starting patients on antibiotics of the Watch category, and organizing structured training sessions for the prescribers are the least measures that a hospital institution can take in order to come back from this situation and also to control the abating menace of cephalosporin-driven resistance.

Keywords: AWaRe classification, Cephalosporins, Watch category, General ward, Antimicrobial stewardship, Ceftriaxone, Drug use evaluation, Antimicrobial resistance, Tertiary care hospital, Rational prescribing, Irrational antibiotic use, ESBL.

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1. Introduction

Antimicrobial resistance is considered one of the most serious challenges to worldwide public health in the twenty-first century. Overuse and misuse of antibiotics in hospitals is one of the main causes of resistance development, leading to multi-drug-resistant organisms (MDROs) that make hospital-acquired These infections then become tougher and, in some cases, completely untreatable [Gao, J et al., 2026; Kilinc, M. et al., 2025].

General wards are the core components of hospital facilities as they admit the most and the most varied patients; however, they lag far behind other hospital areas regarding the research on antimicrobial stewardship. Cephalosporins are the most widely prescribed class of worldwide, recognized for their broad-spectrum, chemically stable, and mainly effective properties [Nagaya, R et al., 2024; Ravi, G et al., 2021].

The use of second- and third-generation antibiotics is mainly in the hospital setting, with ceftriaxone being the most prescribed drug in many tertiary health care centers. Such reliance comes at a heavy price. Extensively using broad-spectrum cephalosporins has been directly associated with the emergence of Extended Spectrum Beta-Lactamase (ESBL)-producing Enterobacteriaceae which can make the whole cephalosporins family useless [Gao, J et al., 2026; Sumon, S. et al., 2024].

Antibiotic resistance due to misuse remains one of the biggest One Health concerns. To that end, WHO introduced a system of antibiotic classification called AWaRe (Access, Watch, Reserve) in 2017 and updated it in 2019 and 2023. It breaks down antibiotics into 3 categories for a more direct implementation of antibiotic stewardship. 'Access' antibiotics are commonly-used ones that treat everyday bacterial infections with less risk of developing resistance to drug. 'Watch' antibiotics include 2nd- and 3rd-line cephalosporins and have the potential of causing resistance if used too frequently. 'Reserve' antibiotics are only used for confirmed multi-drug resistant infections and are kept for last resort use. [Bou-Antoun, S et al., 2025, Kolberg, L et al., 2024]

An important decision of the latest 2023 WHO revision is the change of the status of first-generation Cephalosporins such as cefazolin from Watch to Access, which is a substantial shift at the level of generations, however, the majority of prescribing audits haven't included it yet.

WHO Advocates for a global stewardship target where a minimum of 60% of antibiotics consumption should be from Access group, which after the 2024 United Nations General Assembly Political Declaration on AMR was further raised to 70% by 2030. Nevertheless, data from various countries indicate consistent failure to even get close to these percentages, with drugs from the Watch group - mostly cephalosporins - being the most widely used antibiotics in hospitals in places as diverse as South Asia and sub-Saharan Africa among others [Sumon, S.A, ET AL .,2024; Nakasendwa ET AL.,2026; Kakumba, J.M et al.,2023].

There is still a large and significant evidence gap in this field. Many studies have researched antibiotic prescribing in hospitals at an overall level but few have done so methodically through the AWaRe tool and mainly in general wards as a separate clinical setting. This paper directly targets that gap, by conducting a synthesis of 18 published works spanning 14 countries to describe the cephalosporin prescribing trends in general wards using the AWaRe classification, to find the reasons behind the overuse of Watch category drugs and to recommend stewardship changes through targeted interventions.

Cephalosporin misuse in hospital general wards is more than just a side effect; it is a major and quantifiable source of the global AMR load. Unreasonable prescribing behaviors such as starting broad-spectrum third-generation cephalosporins even for mild or not very specific infections, not changing or stepping down therapy even when microbiological results are available, prescribing Watch-category agents for conditions which Access-category drugs would suffice, and continuing cephalosporin treatment longer than medically required, all produce the selective pressure which leads to resistance at the patient, ward, and hospital levels [Gao, J et al.,2026; Kilinc, M. et al., 2025].

These are not isolated cases; rather, they are the predominant prescribing trends in general wards of tertiary care hospitals on every continent as per the studies integrated in this review.

The consequences of this misuse are both clinical and economic. At the clinical level, the selection of ESBL-producing and other Cephalosporin-resistant bacteria in wards leads to treatment failure, the need for Reserve-category drugs such as carbapenems, longer hospital stays, and additional patient deaths [Kilinc, M et al., 2025; Gavi, F et al., 2023]. At the economic level, higher drug costs, an increased budget for infection prevention, and the systemic cost of managing infections resulting from antibiotic resistance are the major facets of misusing Cephalosporins in hospital wards.

Issues that could have been prevented by proper antibiotic stewardship. Especially in LMICs, where the abuse of Watch-category cephalosporins is very high and the availability of funds for healthcare is very limited, spending on these becomes most destructive [Kakumba, J authors et al., 2023; Nakasendwa, S authors et al., 2026; Diop, M authors et al., 2025]. Therefore, reducing the misuse of Cephalosporins in general wards is not only a stewardship problem; it is also a patient safety problem, a problem of institutional governance, and it is a public health priority.

2. Cephalosporins: Terms, Types, Medical Use, and Irrational Prescribing

Cephalosporins are a vast and clinically adaptable group of beta-lactam antibiotics, with their structure being defined by the 7-aminocephalosporanic acid core and their mode of action revolving around the blocking of bacterial cell wall synthesis through their binding to penicillin-binding proteins (PBPs). The class was first identified in the 1950s from the fungus Acremonium, and it has been developed through five generations, with each new one being more broad-spectrum, more resistant to beta-lactamases and having better tissue penetration.

Cephalosporins globally remain one of the groups of antibiotics most widely prescribed, and account for quite a large proportion of antibiotic use in hospital settings in both high-income and LMIC healthcare systems [Ravi, G et al., 2021; Bou-Antoun et al., 2025].The five generations of cephalosporins differ substantially in their spectrum of activity, clinical indications, AWaRe classification, and prescribed doses all of which are summarized in Table 1. First-generation agents which are now classified as Access according to 2023 WHO AWaRe update, therapeutically work mostly against gram-positive bacteria and are generally used for surgical prophylaxis, skin and soft tissue infections, and uncomplicated urinary tract infections [Bou-Antoun et al., 2025]. As for second-generation agents, cefuroxime is among those that increase gram-negative coverage and have been assigned the Watch status. Third-generation Cephalosporins such as ceftriaxone, cefotaxime, ceftazidime, and cefixime are class of broad-spectrum antibiotics active against Enterobacteriaceae. They are also the principal antibiotics used in hospital inpatient settings globally; however, all of these antibiotics are considered Watch antibiotics and their use needs to be regulated by indication-specific use [Bou-Antoun et al., 2025; Kolberg, L et al., 2024].

Fourth- and fifth-generation agents, including cefepime and Ceftaroline, are reserved for resistant or complex clinical scenarios and carry Watch or Reserve designations in most stewardship frameworks. The scope for the clinical use of Cephalosporins covers a wide array of infectious diseases. Third-generation drugs are the reference antibiotics for pulmonary infections acquired outside hospitals, bacterial infections of the brain lining, urinary infections that are complicated, typhoid fever, and bacterial peritonitis without surgical source. When used in these situations following appropriate clinical diagnosis and susceptibility testing, they are very effective clinically. The problem is not the correct use but the widespread irrational use pattern in the wards that surround them [Nagaya, R et al., 2024; Ravi, G et al., 2021]. Irrational Cephalosporin use covers a wide variety of interrelated prescribing errors. The biggest problem among them is the blanket use of antibiotics without testing the bacteria first, the usual way is to take third-generation cephalosporins of the Watch category like ceftriaxone for children with fever without a clear cause, children with general infections, or with conditions that are usually treated with drugs having a narrower spectrum [Nagaya, R et al., 2024; Ravi, G et al., 2021].

Recently, it has become common practice among some physicians not to de-escalate even when culture sensitivity data become available showing susceptibility to narrower Access-category agents, Watch-category Cephalosporins are often continued without review [Tadesse, T.Y et al;2022;Christina, S et al., 2025].Another antibacterial drugs cephalosporins pattern is the overuse of prophylaxis through prolonging peri-operative cephalosporin prophylaxis beyond the recommended time and using Watch-category agents for prophylaxis whereas the efficacy of cefazolinthe first-generation agent is known [Bou -Antoun et al., 2025].Finally, Cephalosporins are frequently prescribed for viral infections or other non-bacterial ailments where antibiotics do not provide any therapeutic benefit, thus creating a selection pressure without any clinical gain [Sheikh, S et al., 2025]. All these together are a total breakdown of rational antibiotic use which Aware framework was precisely created to uncover, quantify, and remedy.

Table 1. Types of Cephalosporins

Generation & AWaRe Category	Generic Name	Mechanism of Action (MOA)	Primary Clinical Uses	Standard Prescribed Doses	Reference
First Generati	Cefazolin	It prevents the	Some of the	IV/IM : 1–2 g	Sanford Guide; WHO AWaRe

Generation & AWaRe Category	Generic Name	Mechanism of Action (MOA)	Primary Clinical Uses	Standard Prescribed Doses	Reference
on (Access — WHO AWaRe 2023)		formation of bacterial cell walls by attaching itself to PBPs (penicillin-binding proteins), thereby stopping the transpeptidation and causing the cells to burst.	major reasons to use it are surgery prevention, skin and soft tissue infections, noncomplicated UTI, bone and joint infections, and penicillin allergy alternative.	every 8 h (adults); surgical prophylaxis: 2 g single pre-operative dose	2023 (Joint Formuary committee,2024;WHO,2023)
First Generation (Access — WHO AWaRe 2023)	Cefalexin	Identical to cefazolin PBP binding and cell wall crosslinki	Uncomplicated UTI; streptococcal pharyngitis; skin &	Oral: 250–500 mg every 6 h (adults); 25–	British National Formulary (BNF); WHO Model Formulary(Joint Formuary

Generation & AWaRe Category	Generic Name	Mechanism of Action (MOA)	Primary Clinical Uses	Standard Prescribed Doses	Reference
		ng inhibition; leading to bactericidal effect. .	soft tissue infections; moderate bone infections	50 mg/kg/day in divided doses (paediatric)	committee,2024;WHO,2023)
First Generation (Access — WHO AWaRe 2023)	Cefadroxil	Bactericidal; It blocks bacterial cell wall synthesis by binding to PBP; Its longer half-life than cefalexin allows dosing only twice a day.	Infections of skin and soft tissue; Pharyngitis; Tonsillitis; Uncomplicated UTIs	Oral: 1–2 g/day in 1–2 divided doses (adults)	BNF; WHO Model Formulary (Joint Formuary committee,2024; WHO,2023)
Second Generation (Watch — WHO	Cefuroxime	PBP inhibition with extended gram-negative spectrum	Community-acquired pneumonia;	IV/IM: 750 mg, 1.5 g every 8 h Oral:	Sanford Guide; NICE Guidelines; [Gilbert et al,2024; NICE,2023]

Generation & AWaRe Category	Generic Name	Mechanism of Action (MOA)	Primary Clinical Uses	Standard Prescribed Doses	Reference
AWaRe)		relative to first generation; beta-lactamase stable	Sinusitis; Otitis media; Skin infections; Surgical prophylaxis requiring gram-negative coverage	250, 500 mg twice daily	
Second Generation (Watch — WHO AWaRe)	Cefaclor	Bactericidal; PBPs binding; more extended anti-Haemophilus influenzae and anti-Moraxella catarrhalis activities vs. 1st generation	Respiratory tract infections; ear infections; sinus infections; urinary tract infections	Oral: 250–500 mg every 8 h (adults); 20–40 mg/kg/day (paediatric)	BNF; WHO Model Formulary(Joint Formuary committee,2024;WHO,2023
Third Generation (Watch — WHO AWaRe)	Ceftriaxone	Wide-spectrum PBP inhibitor; highly resistant to the action of various beta-lactamases; prolonged half-life (6-9 h) supports administration once a day	Community-acquired pneumonia; bacterial meningitis; sepsis; typhoid; spontaneous bacterial peritonitis; gonorrhoea; intra-abdominal infections	IV/IM: 1–2 g once daily (adults); meningitis: 2–4 g once daily; paediatric: 50–100 mg/kg/day	WHO Essential Medicines List; Sanford Guide; [WHO,2023;Gilbert et al,2024]
Third Generation (Watch — WHO	Cefotaxime	- Binding of PBP; wide range of gram-negative spectrum	Bacterial meningitis; septicaemia; respirat	Injection into the vein/muscle: 1, 2 g every	Sanford Guide; WHO Model Formulary(Gilbert et al,2024;WHO, 2023)

Generation & AWaRe Category	Generic Name	Mechanism of Action (MOA)	Primary Clinical Uses	Standard Prescribed Doses	Reference
AWaRe)		including Enterobacteriaceae; gets converted into the active metabolite called desacetylcefotaxime inside the body	ory and urinary tract infections; gonorrhoea	8, 12 h (adults); meningitis: 2 g every 4, 6 h	
Third Generation (Watch — WHO AWaRe)	Ceftazidime	Extended spectrum PBP inhibitor with significant anti-pseudomonal activity; susceptible to some ESBLs	Pseudomonal infections; nosocomial pneumonia; febrile neutropenia; melioidosis; complicated UTI	IV/IM: 1–2 g every 8 h (adults); higher doses in pseudomonal or severe infections	Sanford Guide; [Gilbert et al,2024;Joint Formulary Committee,2024]
Third Generation	Cefixime	An oral third-generation	Simple infections like	Oral: 400 mg	WHO Essential Medicines

Generation & AWaRe Category	Generic Name	Mechanism of Action (MOA)	Primary Clinical Uses	Standard Prescribed Doses	Reference
(Watch — WHO AWaRe)		drug; stable to many beta-lactamases; kill bacteria by PBP inhibition	UTI; typhoid; gonorrhoea; middle ear infection; sore throat/tonsil inflammation by organisms that are drug-sensitive	once daily or 200 mg twice daily (adults); 8 mg/kg/day (paediatric)	List; BNF(WHO,2023;Joint Formulary Committee,2024)
Fourth Generation (Watch — WHO AWaRe)	Cefepime	Inhibitor of PBP with extended spectrum that also has a good activity against Pseudomonas and improved activity	Hospital-acquired pneumonia, febrile neutropenia, complicated UTI, nosoco	IV: 1-2 grams every 8-12 hours (adults); febrile neutropenia: 2 grams	Sanford Guide; IDSA Guidelines; [Gilbert et al,2024;Freifeld et al,2011]

Generation & AWaRe Category	Generic Name	Mechanism of Action (MOA)	Primary Clinical Uses	Standard Prescribed Doses	Reference
		against Gram-positive bacteria. It is stable in the presence of AmpC beta-lactamases. Zwitterionic nature helps in penetrating the outer membrane.	mial sepsis, Pseudomonas and Enterobacter infections	every 8 hours	
Fifth Generation (Watch/ Reserve)	Ceftaroline	New PBP inhibiting compound; a distinctive covalent binding of PBP2a allows bactericidal effect on MRSA; also keeps	MRSA infections of the skin and soft tissue; community-acquired bacterial pneumonia	Intravenous (IV): 600 mg twice a day (adults); each dose given by infusio	FDA prescribing information; IDSA MRSA Guidelines(Freifeld et al, 2011;allergan USA Inc, 2023)
		a broad spectrum of gram-negative capability.	including resistant strains to first generation cephalosporins.	n over 1 hour	
Fifth Generation (Watch/ Reserve)	Ceftolozane/ Tazobactam	Ceftolozane targets several PBPs of resistant gram-negative bacteria with a strong binding capacity; according to the product insert, it is combined with the beta-lactamase inhibitor tazobactam to	Complicated intra-abdominal infections; Hospital-acquired pneumonia; MDR Pseudomonas aeruginosa infections	IV: 1.5 g (ceftolozane 1 g/tazobactam 0.5 g) every 8h; adjusted dosing according to renal function	FDA/EMA prescribing information; IDSA/ESCMID Guidelines (Freifeld et al, 2011; Merk Sharp and Dohme B.V, 2023)

Generation & AWaRe Category	Generic Name	Mechanism of Action (MOA)	Primary Clinical Uses	Standard Prescribed Doses	Reference
		further increase the spectrum against ESBL/AmpC producers.			

The summary of characteristics of the 18 studies reviewed is presented in Table 2. The studies were conducted in 14 countries across South Asia, sub-Saharan Africa, East Asia, Europe, and the Western Pacific. There was significant variation in design, setting, and sample size of the studies. However, one strong conclusion can be drawn from almost all geographical and institutional settings examined: general ward antibiotic prescribing is heavily dominated by Watch-category cephalosporins, and Access antibiotic proportions remain below WHO-recommended levels.

Table 2. Characteristic 0f Recent study of Cephalosporins

S. No.	Year	Study Design	Setting	Sample / Scope	Key AWaRe Finding	Key AWARE Findings	References
1	2026	China	Retrospective study	Hospital, Suzhou	UTI patients (2020–2024)	High resistance to third-generation cephalosporins in gram-negative organisms; 47.3% ESBL patterns documented	Gao ,et al.2026
2	2026	Pakistan / Egypt / Indonesia	Patient-level analysis	Private primary care, LMICs	IQVIA prescriber data	Watch antibiotics prescribed for more frequently (71.4%) than Access alternatives across all three countries.	Naguyen,et al.2026
3	2026	Uganda	Trend analysis / PPS	Tertiary hospitals (2020, 2023)	Multiple annual surveys	Watch-category antibiotics continued to be the most dominant (55-70%) throughout different years of the survey;	Nakasendwa, et al.2026

						cephalosporins were a major part	
4	2025	Turkey	Retrospective analysis	ICU, tertiary hospital	ICU patients with cultures	Antibiotic resistance associated with mortality; 74% Watch exposure preceded resistance	Kilinc,et al.2025
5	2025	Turkey	Point prevalence survey	Tertiary care hospital	Inpatients on survey day	Watch antibiotics dominant (63.1%); Access proportion below WHO 60% threshold.	Celik,et al.2025
6	2025	Senegal	Point prevalence survey	Tertiary care hospital	Inpatients on survey day	Watch antibiotics comprised 61.5%; cephalosporins promine	Diop ,et al.2021
						nt in medical and surgical wards	
7	2025	India (Manipur)	Cross-sectional	OPD, tertiary hospital	OPD prescriptions	Watch cephalosporins most frequently dispensed (72.4%); AWaRe not used to guide selection	Christina,et al.2025
9	2025	UK	Consensus study	National stewardship policy	Expert panel	100% consensus achieved; first-generation cephalosporins reclassified as Access	Bou ,et al.2025
10	2024	India (South)	Observational	Tertiary hospital,	Diabetic foot patients	Prescriptions of ceftriaxone (61.5%) and cefuroxime (29.6%) topped	Nagaya, et al.2024

						the list even without culture-guided de-escalation.	
11	2024	Bangladesh	Point prevalence survey	Tertiary care hospitals	Admitted inpatients	78% of inpatients received antibiotics; Watch-category agents predominated across wards	Sumom,et al.2024
12	2024	Multi-country Europe	Multicenter observational	Pediatric emergency care	2,327 children	Inconsistent AWaRe-concordant prescribing across European paediatric emergency settings (55.7% cases)	Kolbert, et al.2024
13	2023	Italy	Retrospective	Tertiary	HAI patients	Resistance	Gavi,et al.2023
			observational	urological centre		profiles worsened during the COVID-19 pandemic; broad-spectrum cephalosporins implicated (41.7%)	
14	2023	DR Congo	Cross-sectional	Inpatient wards, Kinshasa	412 prescriptions	Watch-category antibiotics represented 65.8% of prescriptions; Access use below WHO threshold	Kakumaba,et al.2023
15	2022	Japan	Point prevalence survey	Five community hospitals, Okinawa	Inpatients across 5 hospitals	Ceftriaxone was the most used Watch antibiotic (38.2%); guideline-concordant but	Patel,et al.2022

						AWaRe not applied as monitoring tool	
16	2022	Ethiopia	Cross-sectional	Inpatient wards, tertiary hospital	384 prescriptions	Watch-category antibiotics accounted for >60% of prescriptions; Access proportion below WHO target,WHO prescribing indicators applied.	Tadesse,et al.2022
17	2021	India (North)	Prospective observational	General inpatient ward	200 patients	Watch-category broad-spectrum antibiotics comprised a major share (58.3% of prescriptions); most of the empirical prescribing without culture guidance	Ravi ,et al.2021

2.2 Cephalosporins Generations and Their AWaRe Categorization

AWaRe framework makes a clinically decisive distinction within the Cephalosporin class. Access category is where first-generation agents such as cefazolin are placed, and they are still considered appropriate for use in surgical prophylaxis and uncomplicated skin or soft tissue infections. Cefuroxime is the second-generation, whereas all third-generation agents: ceftriaxone, cefotaxime, ceftazidime, and cefixime stay designated as Watch antibiotics, which means that prescription should be accompanied by explicit clinical justification and that they should be actively monitored [Bou-Antoun et al., 2025; Kolberg, L et al., 2024].

An important change in the stewardship potential of this generational differentiation was underlined by a landmark adaptation study from UK. According to this study, the 2023 AWaRe revision moved first-generation Cephalosporins from the Watch to Access category due to their lower resistance potential, usage pattern that is well established, and their main role as alternatives for penicillin-allergic patients [Bou-Antoun et al., 2025].

Nonetheless, in everyday general ward prescribing practice this generational difference which is clinically significant, is still largely ignored and it is very likely that Cephalosporins of all generations would be selected interchangeably and without any consideration of AWaRe category [kakumba, J.M et al., 2023; Celik, M et al., 2025].

2.3 Prescribing Patterns Across Geographic Settings

To the extent of Watch-category Cephalosporin prevalence identified in this review, one can observe that it is not only consistent in its pattern but also widely spread geographically. Take, for example, Bangladesh where a focused prevalence QP survey of antibiotics at tertiary hospitals found that almost 78% of inpatients had been given at least one antibiotic during the survey period. The most common antibiotic agents in all wards, including

medicine, surgery, gynecology, and pediatrics wards, were Watch-category Cephalosporins [Sumon S.A et al., 2024].

A cross-sectional study with WHO prescribing indicators to evaluate the antibiotic prescribing patterns revealed that the use of Watch-category was just as high in inpatient ward types. Also, this study found that documentation of stewardship justification was rarely present [Tadesse, T.Y et al., 2022].

Data from Pakistan and India not only shows high use of Watch-category Cephalosporins but also inconsistency in the application of AWaRe-based stewardship even where such policies are formally in place.

A point prevalence survey in Punjab that was used as a paediatric inpatient evaluation method and based on AWaRe classification showed that majority of the prescriptions were for Watch antibiotics and the compliance to AWaRe was low even in the hospitals that had strict policies [Sheikh, S et al., 2025].

An analysis of AWaRe-guided prescribing in the outpatient departments of tertiary hospital in Manipur found Watch category mediated Cephalosporins as the most dispensed antibiotic agents, while AWaRe categories appeared to have no influence on prescribing decisions [Christina, S et al., 2025].

From the northern India, a prospective study of admitted patients documented widespread empirical use of broad-spectrum Watch antibiotics in a manner that was not commensurate with the clinical complexity of cases managed [Ravi, G et al., 2021], whereas a South Indian study of diabetic foot infection management found ceftriaxone and cefuroxime being the most commonly prescribed antibiotic, with each prescription starting empirically and culture sensitivity testing being completely absent from the decision-making process [Nagaya, R et al., 2024].

Sub-Saharan Africa presents a similar pattern of findings. An AWaRe-based study of antibiotic use in Kinshasa hospitals found that Watch-category drugs were the most commonly prescribed, whereas Access antibiotics were used at levels well below the 60% WHO target [8].According to the Ugandan tertiary hospital point prevalence surveys carried out from 2020 through 2023, there was a constant dominance of Watch-category drugs without any positive trends towards Access antibiotics proportions [Nakasendwa, S et al., 2026].

In Japan, analysis of antibiotic use in five Okinawa community hospitals revealed that ceftriaxone was the most widely used Watch antibiotic for inpatients and it was mostly used for pneumonia, in line with national guidelines for respiratory infections [Patel, P.K et al., 2022].

The main issue with the guideline is not that the guideline itself is completely wrong, but rather that even usage of cephalosporins in line with the recommendations will contribute to a rise in the Watch-category drugs if no AWaRe monitoring system is present. This is a stewardship blind spot which allows resistance risk to build up without being noticed.

Another similar survey at a tertiary hospital in Turkey hospital found that the majority of antibiotic drugs used were from the Watch-category and the proportion of Access drugs was below the level recommended by WHO [Celik, M et al., 2025].

A patient-level approach to analyzing AWaRe prescribing patterns for acute infections in Pakistan, Egypt, and Indonesia has revealed that the situation of using mostly Watch-category antibiotics is not limited to hospital wards only but also applies to outpatients in low and middle-income countries (LMIC) where the Access alternative antibiotics are always the least utilized ones [Nguyen, N et al., 2026].

2.4 Factors Maintaining Watch-Category Cephalosporin Overuse

The ongoing use of Watch-category Cephalosporins as the most prescribed antibiotics in hugely different healthcare contexts probably indicates several layers of structural and behavioral factors interacting. Prescribing based on empirical evidence only, without microbiological results, accounts for the major share of these. In the study of diabetic foot infections in South India authors found that not a single prescription was based on microbiological results, in fact both initiation and continuation phases of treatment were without culture sensitivity testing [Nagaya, R et.al., 2024].

Furthermore, a similar scenario was observed in northern Indian grouping too [Ravi, G et.al., 2021].

Culture data being unavailable means doctors even lack the proof with which they could lower the spectrum of their antibiotic from Watch agents to narrower Access ones, and the empirical default to ceftriaxone gets so deeply reinforced.

Another equally leading reason is that doctors do not know much about the AWaRe concept. Pakistan's study showed that even where AWaRe existed in theory its use was very irregular meaning that having a policy does not at all time lead to changing the way a doctor prescribes [Sheikh, S et.al., 2025].

Such pieces of evidence seem to point to the same worrying fact many clinicians are effectively still oblivious to the AWaRe framework which was meant to be their guiding light.

Shortages in Antimicrobial Stewardship Programs (ASPs) serve as one of the major contributors to the amplification of the above two gaps at the individual level. Especially in LMICs, formal ASPs are often non-existent or only barely

executed which means cephalosporin prescribing of the Watch-category proceeds without the systematic use of audit, feedback, and accountability mechanisms which effective stewardship is based on [Kakumba, J et al., 2023;Nakasendwa, S et al., 2026;Diop, M et al., 2025].

Limits on the drug list, pre-approving the use of Watch-category agents, and pharmacist-designed de-escalation protocols are least implemented exactly in those hospitals where their effects would be most significant. Stressing the need for guidelines, a genuine doubt about treatment failure, and considering that broad-spectrum cephalosporins are very safe drugs lead to further pushing of Watch-category agents by prescribers even when in reality Access-category agents would be completely acceptable [Bou-Antoun, S et al., 2025;Tadesse, T.Y et al., 2022].

2.5 Effects on Antimicrobial Resistance

The environmental impact arising from a continuation of the Watch-category Cephalosporin overuse on general wards is not just a hypothesis as it can be already seen in resistance surveillance data. ESBL-producing Enterobacteriaceae, which cause pan-Cephalosporin resistance, are found more and more in hospitals where third-generation Cephalosporin use is high and the link between Watch-category overuse and ESBL selection pressure is thoroughly documented.

Five years retrospective study of urinary tract infection pathogens in Suzhou, China, detailed that the resistance levels towards third-generation Cephalosporins amongst gram-negative organisms remained high and stable, very much in line with extended selective pressure of Watch-category antibiotic use in the nearby healthcare environment [Gao, J et.al., 2026].

The added number of mortalities that were caused by this situation are just as real. Retrospective examination of culture growth results showed resistance to antibiotics was a significant independent predictor of death in ICU patients. Furthermore, in quite a high proportion of these cases, resistance was identified after exposure to Watch-category antibiotics. Hospital-acquired infections at a tertiary urological center worsened their level of resistance throughout the COVID-19 pandemic as a result of increased broad-spectrum antibiotic use including Watch-category Cephalosporins [Gavi, F et.al., 2023].

All in all, these data highlight crucial point: the AWaRe framework is in place to help measure and act on Watch-category antibiotic rates at the facility level, however, the issue is that the vast majority of healthcare systems worldwide is still not employing it for general ward Cephalosporin audits [Bou-Antoun, S et.al., 2025; Kolberg, L et.al., 2024].

At socioculturally different countries, Watch-category cephalosporins are, by far, the most common class of antibiotics prescribed in general hospital wards in both LMICs and high-income countries [Kakumba, J et al., 2023; Nakasendwa, S et al., 2023; Celik, M et al., 2025; Patel, P.K. et al., 2022].

The WHO's Access-target of at least 60% of antibiotic consumption has simply not been met in any of the settings examined when ward-level-cephalosporin use was analysed independently, with the gap between actual and recommended levels being quite large for every geographical location presented in this study.

It is important to stress that it is not only a matter of isolated institutional failures but the whole system of a cross-continental culture of physicians where Watch-category cephalosporins have become the default drug no matter the indication, clinical complexity or microbiological evidence.

Such results are even more alarming if viewed against the background of the recently updated 2023 AWaRe classification which is now providing AWaRe-guided prescribing recommendations for over 30 distinct clinical conditions and also first-generation cephalosporins have been formally assigned Access status [Bou-Antoun et al., 2025].

So the takeaway for general wards has to be actionable: WHO-endorsed cefazolin is an optimal first-line drug for surgical prophylaxis (as well as several other common indications) but the almost universal empirical default to ceftriaxone in general ward settings signifies a systematic disregard of antibiotic appropriateness that is neither clinically justified nor stewardship-supported [Ravi, G et al., 2021; Nagaya, R et al., 2024].

Simply using Access-category cefazolin instead of Watch-category ceftriaxone in suitable patients on a routine basis, would, by itself, greatly enhance AWaRe performance metrics without any compromise in clinical outcomes.

Regional comparison reveals major differences that highlight the problem from other angles. Bangladesh, Uganda, Senegal, and the Democratic Republic of Congo have the highest usage of Watch-category Cephalosporin that are due to heavier infectious disease burdens, almost universal empirical prescribing, and lack of working ASP environments [Sumon, S.A. et al., 2024; Kakumba, J et al., 2023; Nakasendwa, S et al., 2026; Diop, M et al., 2025].

Japan and Turkey, on the other hand, may clinically align quite well with national guidelines on Cephalosporin prescribing.

However, still the proportions of Watch-category remain high because AWaRe is not being used as a monitoring tool [Celik, M et al., 2025; Patel, P.K et al., 2022].

And this distinction does matter: guideline compliance and AWaRe compliance are not equivalent. It is possible that a hospital may follow the pneumonia treatment guideline by prescribing ceftriaxone but at the same time be failing the WHO's 60% Access-category benchmark-this kind of contradiction only surfaces when the AWaRe metrics are actively used.

The evidence perhaps most notably points to the divergence between the AWaRe framework's intent and its actual penetration at the prescriber level. In many cases, AWaRe categories apparently had no influence over the antibiotic selection process and it has been found that even in institutions where AWaRe support exists, it is only applied sporadically [Christina, S et al., 2025; Sheikh, S et al., 2025].

The framework was expected to make a difference in prescribing behaviour increase Access use, decrease Watch use, measurable improvements in the Access-to-Watch ratio. That change has not taken place in general wards, and the proof suggests that it will not happen simply from the classification being passively available.

It is the active, well-organized implementation that actually makes prescribing behaviour change embedding AWaRe criteria into audit tools, integrating AWaRe categories into prescribing software, delivering targeted education, and enabling pharmacist-led de-escalation [Bou-Antoun et al., 2025; Kolberg, L et al., 2024; Tadesse, T.Y et al., 2022].

The irrational use of Cephalosporins that has been highlighted in this review is not a permanently fixed aspect of clinical practice; rather, it is a failure of institutional stewardship infrastructure that can be corrected.

Conclusion

In tertiary care hospitals, Cephalosporin prescribing in general wards is heavily and consistently biased towards the WHO AWaRe Watch category. Among these, third-generation agent ceftriaxone stands out as the dominant antibiotic in almost all settings examined in this review. Access-to-Watch ratios are far below the WHO targets in every geographical region studied. This points to a systemic and global issue rather than an isolated institutional failure resulting from a lack of implementation of the AWaRe framework at the ward level. The misuse of Watch-category cephalosporins by empirical prescribing, not de-escalating treatment, using them as prophylaxis, and prescribing them for non-bacterial conditions results in selection pressure that Favors ESBL, increases treatment failure, and leads to death.

AWaRe-based classification needs to be integrated into routine antibiotic audits in general wards, thereby It should be mandatory to perform culture sensitivity testing before starting or continuing use of Watch-category Cephalosporins, as that gives clinicians the microbiological basis they need to confidently de-escalate treatment. Changes in AWaRe education for prescribers and pharmacists need to be very carefully structured. After all, a framework that remains unknown to the prescribers cannot function as a stewardship tool. Pharmacist-led de-escalation, active formulary management, and Watch-category agents pre-authorization requirements are steps that should be given priority in hospitals that currently do not have a formal stewardship structure in place.

Besides, future research should not only conduct hospital-level aggregate studies but also focus on general wards exclusively. They should apply the 2023 updated AWaRe framework longitudinally and across multiple centres. This will generate a detailed, evidence base that reforms at the policy level stewardship urgently need.

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