

Self-reported antibiotic stewardship practices and perceived barriers and facilitators among healthcare workers in three tertiary hospitals in Sierra Leone: a convergent mixed- methods study

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Abstract

Background: This study aimed to describe self-reported antibiotic management practices and perceived barriers and facilitators among healthcare workers in three tertiary hospitals in Sierra Leone and to integrate survey and interview findings to identify priorities for hospital antimicrobial stewardship.

Methods: This study employed a mixed-methods design, triangulating quantitative data from a cross-sectional survey with qualitative data from key informant interviews. Data were collected in clinical settings at three tertiary referral hospitals in Freetown, Sierra Leone: Connaught Hospital, Princess Christian Maternity Hospital, and Ola During Children's Hospital. The survey included 214 respondents, comprising doctors, nurses, and pharmacists, representing 55.7% of the 384 distributed questionnaires, along with 15 purposively selected key informants.

Results: Clinical guidelines exist across the three facilities, but informed prescribing is influenced by structural and social factors beyond availability. Qualitative interviews revealed concerns about outdated guidelines and whether they applied to the local pathogen picture. Senior physicians whose practices predate stewardship policies favour an experience-based culture that can run counter to updated guidelines. Quantitative data showed that adherence varied across facilities and cadres, with junior prescribers mirroring patterns among seniors. Participants showed awareness of antimicrobial resistance (AMR) risks; however, this did not translate to their prescribing behaviour. Interview data identified a gap: prolonged turnaround times, limited microbiology capacity, treatment availability, and affordability meant that empirical treatment was clinically based. Quantitative analysis indicated that facilities without microbiology lab functions had higher rates of broad-spectrum empirical prescribing. Interviews suggested prescribers may ignore guidelines and prescribe broad-spectrum antibiotics as the “magic bullet” to address these challenges. Participants also described choosing free broad-spectrum agents in settings with unreliable supply chains, not for clinical necessity, but because they were the only available treatment. Antibiotic escalation was also linked in interviews to potential patient severity or deterioration and social expectations from patients and families.

Conclusions: Healthcare workers across the three hospitals reported high awareness of AMR and stewardship-relevant challenges; however, antibiotic decisions were shaped by diagnostic scarcity, medicine availability, affordability, and professional norms. Stewardship efforts should prioritise visible local guidance, stronger microbiology and diagnostic turnaround, reliable antibiotic supply, and repeated multidisciplinary training and feedback.

Background

Antimicrobial resistance (AMR) threatens global health systems by reducing the efficacy of essential drugs. A recent global analysis estimated that bacterial AMR was associated with 4.71 million deaths in 2021, including 1.14 million deaths directly attributable to resistance [1]. Earlier global burden work showed especially high mortality in western sub-Saharan Africa, underscoring the urgency of context-specific stewardship strategies in the region [2]. Hospitals are a critical arena in this response. They

concentrate severely ill patients, high antibiotic exposure, invasive procedures and empirical treatment decisions, while also exposing the limits of diagnostic capacity, infection prevention and supply systems [3, 4]. Antimicrobial stewardship programmes (ASPs) aim to improve antibiotic use without compromising patient care, but the conditions required for effective stewardship are unevenly distributed. Evidence from low-income and middle-income countries (LMICs) shows that stewardship is often constrained by weak microbiology services, restricted formularies, medicine stock-outs, limited staffing and poor access to locally trusted prescribing guidance [3, 6, 7]. Antibiotic decisions are also social decisions. Prescribing behaviour is shaped by hierarchy, informal norms, case severity and the perceived risk of undertreating the individual patient [4, 5]. These pressures are especially visible where laboratory confirmation is delayed or unavailable and where clinicians must weigh ideal treatment against what patients can afford in practice [4, 6, 7].

Sierra Leone has begun to build a stronger evidence-based stewardship, but important operational questions remain. National antibiotic consumption between 2017 and 2019 was estimated at 19 defined daily doses per 1000 inhabitants per day, with access to antibiotics accounting for about two-thirds of total use [8]. At outpatient clinics in three tertiary hospitals in Freetown, antibiotics were prescribed in 31.8% of visits, inappropriate indication was documented in 27.6% of encounters and duration was not stated in 18.6% of prescriptions [9]. A national inpatient point prevalence survey reported antibiotic use in 73.7% of hospitalised patients, with blood culture testing almost absent [10]. Although Connaught Hospital, the national adult referral hospital in Sierra Leone, has since established a multidisciplinary stewardship programme, studies have described high antibiotic use in surgical practice and persistent stewardship gaps in paediatric inpatient care [11–13]. These findings make clear that stewardship in Sierra Leone cannot be treated as a purely educational problem.

What remains less well described is how frontline healthcare workers across tertiary hospitals understand their own prescribing-related practices and the barriers and facilitators that shape them. That gap matters because interventions fail when they assume that prescribers simply need more information, while the daily drivers of antibiotic use remain structural, social and economic [4–7, 14–18].

This study therefore examined self-reported antibiotic decision-making and stewardship practices and perceived barriers and facilitators among doctors, nurses and pharmacists in three tertiary hospitals in Sierra Leone. Using a convergent mixed-methods design, the survey quantified stewardship-relevant practices and perceptions, while key informant interviews explored how guidance, diagnostic uncertainty, medicine availability, affordability and professional norms influenced decision-making. The aim was to generate actionable evidence for hospital antimicrobial stewardship in Sierra Leone.

Methods

Study design

The research design consisted of a convergent mixed-methods study based on methods triangulation, combining a quantitative questionnaire survey and key informant interviews. Data were collected in the hospital setting for three months between 10 April and 10 July 2023. Specific national referral facilities were selected for data collection because of the high rates of AMR locally associated with healthcare settings.

Setting and population

The study was conducted in three tertiary referral hospitals in Freetown, Sierra Leone: Connaught Hospital, Princess Christian Maternity Hospital (PCMH) and Ola During Children's Hospital (ODCH). Connaught Hospital is the main adult referral hospital, PCMH provides maternity and gynaecological care, and ODCH is the national paediatric referral hospital. Together, the facilities represent major tertiary care services within the University of Sierra Leone Teaching Hospitals Complex.

We selected these facilities because they serve as the primary public training institutions and the highest tier of referral care in the country. Baseline research at these sites shows the urgency of hospital-based stewardship. A previous point prevalence survey at Connaught Hospital reported an overall antibiotic prescribing rate of 56.0% among hospitalized patients, which rose to 69.6% in surgical wards [11]. Similarly, a pediatric point prevalence survey at ODCH revealed an overall antibiotic use prevalence of 84.7% among admitted children, while highlighting that the institution lacked the required stewardship infrastructure and policies [13]. The study participants were doctors, nurses and pharmacists working in the three hospitals during the study period. While doctors and pharmacists have formal authority to prescribe and dispense antibiotics, nurses were included because they administer these medications, manage ward-level stock, monitor patients, and communicate drug availability, factors that directly influence prescribing decisions.

Quantitative Data

Data Collection

We deployed a structured, self-administered questionnaire to systematically collect data across the three health facilities (Additional file 1). The questionnaire was designed to capture key variables on decision-making and practices influencing antibiotic prescribing, centred on prescribing decisions/patterns informed by the availability or not of a standardized facility guideline.

Sampling

The target survey sample was 384 healthcare workers, calculated using a single-proportion formula with 95% confidence and 5% precision. Questionnaires were allocated proportionately across hospitals according to staff numbers and distributed in clinical wards, outpatient departments, intensive care

areas and hospital pharmacies. Recruitment was pragmatic, with staff approached while on duty and invited to complete a short self-administered questionnaire in paper or digital format. Selected items (beliefs on factors contributing to antimicrobial resistance) were adapted from prior stewardship research in LMIC hospitals [6]; all other items (respondent characteristics, facility context, self-reported antibiotic prescribing practices, perceived access to guidelines, and guideline review frequency) were developed for this study (Additional file 1).

Data Analysis

Quantitative data were analysed descriptively using frequencies, percentages, medians and interquartile ranges. Categorical variables were compared across hospitals and professional groups using chi-square or Fisher exact tests as appropriate. Ordinal responses were analysed using non-parametric methods. Exploratory logistic regression models were fitted for binary outcomes with adequate cell sizes, with hospital entered as a fixed effect. Adjusted odds ratios (aORs), 95% confidence intervals (CIs) and p values are reported. Analyses used available-case denominators and complete-case analysis for multivariable models.

Qualitative Data

Data collection

We conducted concurrent key informant interviews to gather qualitative data from doctors, nurses, and pharmacists involved in direct patient care or medicine management across the three hospitals. This qualitative strand informed our concurrent parallel design by providing explanatory depth for the interpretation of the quantitative survey results. Its purpose was to explore hidden institutional drivers, including informal hospital norms and professional hierarchies, that shape daily health worker practices.

We selected semi-structured, in-depth interviews instead of direct observation or informal conversations. Direct observation was excluded because it could disrupt clinical workflows and alter the participants' natural behaviour. Informal conversations were excluded because they did not support systematic recorded analysis.

Interviews used a semi-structured guide developed for this study (Additional file 2) that allowed standardised questions with flexibility to pursue unexpected insights across the clinical and social domains. It covered antibiotic choice, guidelines, local diagnostic capacity, medicine availability, patient affordability, and views on antimicrobial stewardship. Interviews were conducted at the facilities but outside the clinical settings to avoid service disruption. They were conducted in English, lasted approximately 30 minutes, and were audio-recorded and transcribed.

Sampling

We employed a purposive sampling approach to capture a broad range of perspectives across the facilities. Key informants were selected to ensure maximum variation across different professional cadres and clinical settings. We conducted a total of 15 key informant interviews across the three study sites. To maintain an equal distribution, five interviews were conducted in each hospital, comprising two doctors, two nurses, and one pharmacist.

Data analysis

Based on the study design, data analysis was concurrent with the quantitative component and iterative. Interview transcripts were analysed thematically using an approach that combined deductive coding from the interview guide with inductive coding from the data. Two researchers independently coded an initial subset of transcripts, discussed differences, refined the coding framework and applied it to the full interview set. Themes were developed through constant comparison across hospitals and professional groups. The interview sample was planned to achieve representation across sites and cadres rather than formal saturation. The analysis was done using NVivo Qualitative Analysis software (QSR International Pty Ltd). No other software package was used for the qualitative data management.

Mixed-methods integration

We used a parallel mixed-methods sampling approach. We drew both quantitative and qualitative samples concurrently from the same underlying population of healthcare workers. This facilitated direct integration during the interpretation phase. Integration occurred at the interpretation phase without data transformation. After analysing both datasets separately, we identified shared stewardship domains present in both the survey outcomes and the qualitative themes. These included guideline utilisation, diagnostic capacity, and medicine affordability. We mapped the findings within these shared domains side-by-side using a joint display matrix. This technique facilitated weakness minimisation. We explicitly assessed the data for convergence where findings agreed, divergence where they contradicted, and complementarity where qualitative interview data explained the quantitative survey patterns.

We assigned equal priority to both data strands and analysed them independently before merging them during the interpretation phase. We chose a convergent design to triangulate broad self-reported stewardship practices from the surveys with an in-depth understanding of the contextual and structural factors driving those practices from the interviews. This approach yields a more comprehensive understanding of antibiotic decision-making than either method could achieve alone.

Reflexivity and Researcher Positionality

We engaged in reflexivity throughout the study to ensure qualitative rigor. FBB, AKB, SFFS and AIB conducted the interviews. They are trained in qualitative methodologies and have experience in public health research. The interviewers were not in direct supervisory roles over the participants. This minimised social desirability bias and power imbalances. We held regular debriefing sessions during data collection and analysis. This allowed us to critically examine how our own clinical and academic

backgrounds might influence data interpretation. It ensured the final themes remained firmly grounded in the participants' perspectives.

Results

Participant characteristics

Of 384 distributed questionnaires, 214 were returned with usable data, giving a response rate of 55.7%. Respondents were drawn from PCMH (86/214, 40.2%), Connaught Hospital (76/214, 35.5%) and ODCH (52/214, 24.3%). Women comprised 71.0% (152/214) of the sample. Nurses were the largest professional group (147/214, 68.7%), followed by doctors (37/214, 17.3%) and pharmacists (29/214, 13.6%). Among respondents with valid age data, the median age was 30 years (IQR 27 to 35). Most respondents had worked in their facility for more than 2 months (188/214, 87.9%), and 127/209 (60.8%) reported 1 to 5 years of clinical experience managing antibiotics (Table 1).

Table 1
Participant characteristics overall and by hospital

Characteristic	Overall	Connaught	PCMH	ODCH	P value
Total participants	214	76	86	52	
Age, median (IQR), years	30 (27–35)	32 (28–35)	30 (27–36)	29 (27–35)	0.608
Sex: Male	62 (29.0)	32 (42.1)	10 (11.6)	20 (38.5)	< 0.001
Sex: Female	152 (71.0)	44 (57.9)	76 (88.4)	32 (61.5)	
Profession: Doctor	37 (17.3)	25 (32.9)	7 (8.1)	5 (9.6)	< 0.001
Profession: Nurse	147 (68.7)	44 (57.9)	68 (79.1)	35 (67.3)	
Profession: Pharmacist	29 (13.6)	6 (7.9)	11 (12.8)	12 (23.1)	
Profession: Mixed/other	1 (0.5)	1 (1.3)	0 (0.0)	0 (0.0)	
Age group: 18–29	91 (44.0)	26 (36.1)	39 (45.9)	26 (52.0)	0.057
Age group: 30–39	93 (44.9)	41 (56.9)	32 (37.6)	20 (40.0)	
Age group: 40+	23 (11.1)	5 (6.9)	14 (16.5)	4 (8.0)	
Age missing	7	4	1	2	
Time working at facility: >2 months	188 (87.9)	64 (84.2)	78 (90.7)	46 (88.5)	0.595
Time working at facility: <2 months	24 (11.2)	11 (14.5)	8 (9.3)	5 (9.6)	
Time working at facility: Ambiguous	2 (0.9)	1 (1.3)	0 (0.0)	1 (1.9)	
Time prescribing/administering antibiotics: <1 year	19 (9.1)	11 (14.7)	7 (8.3)	1 (2.0)	0.053
Time prescribing/administering antibiotics: 1–5 years	127 (60.8)	47 (62.7)	46 (54.8)	34 (68.0)	
Time prescribing/administering antibiotics: >5 years	60 (28.7)	15 (20.0)	31 (36.9)	14 (28.0)	
Time prescribing/administering antibiotics: Unclear/non-prescriber	3 (1.4)	2 (2.7)	0 (0.0)	1 (2.0)	

Characteristic	Overall	Connaught	PCMH	ODCH	P value
Prescribing-years missing	5	1	2	2	

Values are n (%) unless otherwise stated. Age group percentages use non-missing age as the denominator. P values are from chi-square tests for categorical variables and Kruskal-Wallis for age.

Self-reported practices relevant to stewardship

Most respondents reported that antibiotic prescribing guidelines were available in their facility (173/214, 80.8%). Two-thirds reported starting with narrow-spectrum antibiotics first (149/214, 69.6%), and 141/212 (66.5%) said they considered the patient's economic background before prescribing. Only 82/213 (38.5%) said they would consider intravenous antibiotics over oral therapy for all patients. Among respondents who reported guideline availability, 102/173 (59.0%) said guidelines were reviewed annually.

Several practices varied by hospital and professional group (Table 2). Reporting narrow-spectrum-first antibiotic selection differed by hospital, from 56.6% at Connaught Hospital to 75.6% at PCMH and 78.8% at ODCH ($p = 0.008$). Reporting intravenous-over-oral preference for all patients also varied by hospital ($p = 0.039$) and profession ($p < 0.001$). By profession, doctors were less likely than nurses or pharmacists to report guideline availability ($p = 0.005$), but more likely to report considering patient affordability before initiating therapy ($p = 0.001$).

Perceived barriers and facilitators

Agreement was high for several stewardship-relevant barriers. Lack of adequate diagnostic tests leading to antibiotic overuse was endorsed by 191/213 respondents (89.7%), inappropriate antibiotic use as a major cause of AMR by 189/213 (88.7%), easy access to antibiotics without prescription by 188/213 (88.3%), and lack of close clinical follow-up during antibiotic use by 193/213 (90.6%). Sporadic antibiotic supply was also widely viewed as contributing to AMR (174/213, 81.7%). These items are reported individually rather than as a composite score because they capture distinct stewardship problems (Table 2).

Table 2

Key self-reported practices and perceived barriers and facilitators overall and by professional cadre

Measure	Overall	Doctor	Nurse	Pharmacist	P value
Self-reported antibiotic management practices and facilitators					
Reports facility has antibiotic prescribing guidelines	173 (80.8)	23 (62.2)	123 (83.7)	26 (89.7)	0.005
Always starts with narrow-spectrum antibiotics first	149 (69.6)	19 (51.4)	109 (74.1)	21 (72.4)	0.025
Considers IV over oral antibiotics for all patients	82 (38.5)	3 (8.1)	69 (47.3)	10 (34.5)	< 0.001
Considers patient economic background before prescribing/initiating therapy	141 (66.5)	34 (91.9)	88 (60.7)	18 (62.1)	0.001
Guideline review frequency among respondents reporting guidelines					< 0.001
Every year	102 (59.0)	5 (21.7)	82 (66.7)	15 (57.7)	
Every 2 years	48 (27.9)	5 (21.7)	38 (30.9)	5 (19.2)	
Every 5 years	11 (6.4)	4 (17.4)	3 (2.4)	4 (15.4)	
Others	11 (6.4)	9 (39.1)	0 (0.0)	2 (7.7)	
Usual antibiotic duration					0.138
<1 week	62 (29.1)	9 (24.3)	46 (31.3)	7 (24.1)	
1 week	101 (47.4)	23 (62.2)	63 (42.9)	15 (51.7)	
2 weeks	15 (7.0)	4 (10.8)	10 (6.8)	1 (3.4)	
>2 weeks	35 (16.4)	1 (2.7)	28 (19.0)	6 (20.7)	
Perceived contributors/barriers to appropriate antibiotic use or AMR (Agree/Strongly agree)					
AMR is a problem in my daily practice	159 (74.6)	31 (83.8)	107 (72.8)	21 (72.4)	0.372
Inappropriate antibiotic use is a major cause of AMR	189 (88.7)	37 (100.0)	126 (85.7)	26 (89.7)	0.048

Measure	Overall	Doctor	Nurse	Pharmacist	P value
Self-reported antibiotic management practices and facilitators					
Easy access to antibiotics without a prescription contributes to AMR	188 (88.3)	37 (100.0)	126 (85.7)	25 (86.2)	0.051
Lack of adequate diagnostic tests leads to overuse	191 (89.7)	35 (94.6)	130 (88.4)	26 (89.7)	0.546
Sporadic supply of antibiotics contributes to AMR	174 (81.7)	32 (86.5)	117 (79.6)	25 (86.2)	0.497
Lack of close clinical follow-up contributes to AMR	193 (90.6)	33 (89.2)	134 (91.2)	26 (89.7)	0.918
Patient demands and expectations increase overuse	172 (80.8)	27 (73.0)	121 (82.3)	24 (82.8)	0.418
Prescription of broad-spectrum antibiotics is directly linked to AMR	158 (74.2)	27 (73.0)	110 (74.8)	21 (72.4)	0.948

Values are n (%). For Likert items, the table reports Agree or Strongly agree. Overall denominators exclude missing responses where applicable. One mixed/other respondent was excluded from profession-stratified analyses.

Exploratory multivariable analysis

In the primary exploratory logistic model, nurses were more likely than doctors to report that antibiotic prescribing guidelines were available in their facility (aOR 2.88, 95% CI 1.04 to 8.01). The corresponding estimate for pharmacists compared with doctors was in the same direction but imprecise (aOR 4.23, 95% CI 0.95 to 18.90). Associations with hospital, sex and prescribing experience were not clearly supported in this model (Table 3).

In a secondary exploratory model, reporting narrow-spectrum-first selection was more common at PCMH (aOR 2.20, 95% CI 1.05 to 4.63) and ODCH (aOR 3.29, 95% CI 1.34 to 8.09) than at Connaught Hospital, and more common among nurses than doctors (aOR 2.75, 95% CI 1.06 to 7.12). These findings should be interpreted cautiously because the questionnaire did not measure clinical case mix or prescribing and administration authority.

Table 3
Exploratory multivariable model for reported facility guideline availability

Predictor	aOR (95% CI)	P value
Hospital: ODCH vs Connaught	2.02 (0.70 to 5.84)	0.194
Hospital: PCMH vs Connaught	1.14 (0.48 to 2.69)	0.762
Profession: Nurse vs Doctor	2.88 (1.04 to 8.01)	0.042
Profession: Pharmacist vs Doctor	4.23 (0.95 to 18.90)	0.059
Sex: Female vs Male	1.34 (0.53 to 3.39)	0.533
Antibiotic management experience: 1–5 years vs < 1 year	0.71 (0.18 to 2.85)	0.626
Antibiotic management experience: >5 years vs < 1 year	0.38 (0.09 to 1.65)	0.197

Model restricted to respondents with non-missing data on all included covariates and to clearly classified professions (n = 205).

Qualitative themes

Guidelines supported decision-making, but hierarchy mediated their use

Participants across hospitals described treatment guidelines as useful references, especially when they were visible and easy to retrieve at the point of care. At the same time, they described prescribing shaped by accumulated experience and the observed practice of senior colleagues, suggesting that formal guidance and informal authority operated in parallel.

There is a guideline. And so normally I would refer to the guidelines to prescribe and then also to be honest it facilitates the rational uses, like a reference that you can go to, to prescribe an antibiotic that is also very useful.

Doctor, Connaught Hospital

I would at times prescribe based on what a senior colleague has been doing, just give an antibiotic based on what you've seen a senior colleague has been giving for a similar condition, so guidelines and at times we just go by experience.

Doctor, Connaught Hospital

Diagnostic uncertainty sustained empirical treatment

Respondents linked delayed laboratory results and absent culture and susceptibility testing to continued empirical prescribing, particularly when clinicians believed the patient could not safely wait for

confirmation.

The delay in some of the diagnostics is one of the reasons why people instead of giving a specific antibiotic, they just prescribe because the results are not available on time and the patient might need something.

Doctor, Connaught Hospital

For now, I can say we don't have the facility here for culture and sensitivity.

Doctor, PCMH

Affordability and medicine availability constrained antibiotic choice

Participants described antibiotic decisions as bounded by what patients could afford and what hospital pharmacies could actually dispense. The antibiotic written was not always the antibiotic obtained or completed.

Most of the patients that come to the facility can barely afford the antibiotics that are prescribed. So most of the time, they'll just go home and take whatever they can afford.

Doctor, Connaught Hospital

The main factor that affects antibiotic dispensing at ODCH is the availability of the product, because in most cases prescriptions come in and we don't have the particular antibiotic.

Pharmacist, ODCH

Stewardship was seen as necessary but under-supported

Interviewees framed stewardship as a shared responsibility rather than the work of a single cadre. They called for more visible stewardship activity, repeated reminders and training that reached doctors, nurses, pharmacists and trainees.

They should do more training programs to educate the clinical family, not just the doctors, even the pharmacists, and even medical students and the nurses too.

Doctor, Connaught Hospital

Integrated findings

Integrating the two data strands revealed strong convergence and complementarity across four primary stewardship domains. These domains were guideline utilisation, diagnostic capacity, affordability, and prescribing norms (Table 4). The quantitative results indicated high awareness of AMR and widespread availability of guidelines. The qualitative findings provided complementary evidence explaining why this

awareness did not consistently translate into practice. The data converged to show that structural constraints frequently overrode individual stewardship intentions. Such constraints included delayed microbiology results and frequent medicine stock-outs. Furthermore, survey data showed a quantitative preference for narrow-spectrum antibiotics. The interview data provided essential context here. It revealed that hierarchical pressures and severe clinical presentations frequently necessitated justifiable deviations from first-line protocols.

Table 4
Joint display of integrated findings

Quantitative finding	Qualitative explanation	Integrated interpretation	Implication
80.8% reported facility antibiotic prescribing guidelines; doctors were less likely than nurses to report guideline availability in exploratory modelling.	Participants described guidelines as helpful when visible and accessible, but also said they sometimes relied on what senior colleagues had been doing.	Guidelines appear to exist in some settings, but visibility, credibility and local hierarchy determine whether they are used in day-to-day decisions.	Make guidelines highly visible at point of care, pair them with local champions, and audit whether staff know where to find them.
89.7% agreed that lack of adequate diagnostic tests leads to antibiotic overuse.	Interviewees described delayed results, absent culture and sensitivity facilities, and empirical prescribing because patients 'might need something' before results return.	High AMR awareness is not enough when clinicians lack timely microbiology support. Structural diagnostic uncertainty sustains empirical therapy.	Prioritise basic microbiology, faster turnaround and diagnostic stewardship alongside AMS.
66.5% reported considering patient affordability; interviewees also described stock-outs and referral to community pharmacies when hospital pharmacies lacked antibiotics.	Participants reported that many patients could not afford the prescribed medicine and would instead buy whatever they could manage.	Antibiotic choice is shaped by affordability and supply, not just prescriber knowledge. Stewardship therefore has financing and procurement dimensions.	Improve essential antibiotic availability, reduce stock-outs, and align stewardship with patient-cost realities.
69.6% reported starting with narrow-spectrum antibiotics first, but this varied by hospital and cadre.	Clinicians said severe illness could prompt immediate escalation beyond first-line therapy, and some described prescribing by experiential norms or senior example.	Self-reported stewardship-oriented intentions coexist with severity-driven escalation and social norms around antibiotic use. This is not simply a knowledge problem.	Use case-based audit and feedback, bedside decision support, and senior clinician engagement to reduce unjustified escalation while preserving flexibility for severe illness.

Discussion

This study adds a hospital-level account of how antibiotic decisions are made in three tertiary facilities in Sierra Leone. The central finding is not that healthcare workers lacked awareness of AMR. Respondents strongly recognised that inappropriate use, easy access to antibiotics without prescription, inadequate diagnostics and weak follow-up contribute to resistance. The more important finding is that stewardship-relevant knowledge operated within clear structural constraints. Survey responses and interviews converged on the same point: antibiotic decisions were shaped by what could be diagnosed, what was available, what patients could afford and whose judgement carried weight in the clinical setting.

The findings on guidelines illustrate this well. Most respondents reported that antibiotic prescribing guidelines were available, and several interviewees described them as useful anchors for everyday decisions. That is encouraging, because accessible guidance is a consistent facilitator of stewardship in LMIC hospitals [3, 6, 7]. Yet the qualitative data showed that guideline presence does not guarantee guideline authority. Respondents also described prescribing on the basis of prior experience or the observed practice of senior colleagues. This pattern mirrors the ‘prescribing etiquette’ described by Charani and colleagues, in which hierarchy, specialty culture and non-interference shape antimicrobial decisions [5]. It also aligns with qualitative syntheses showing that prescribers may endorse stewardship in principle while defaulting to socially reinforced, risk-averse choices in practice [4, 14]. Guidelines need local ownership, point-of-care visibility and endorsement by senior clinicians if they are to compete with habit and hierarchy.

Diagnostic limitation emerged as the clearest system-level barrier. Nearly 90% of respondents agreed that lack of adequate diagnostic tests leads to antibiotic overuse, and interviewees linked delayed or absent microbiology directly to empirical prescribing. That interpretation is consistent with broader hospital literature. Diagnostic uncertainty repeatedly drives over-treatment because clinicians face the immediate risk of deterioration in the individual patient and the delayed, probabilistic risk of resistance in the wider population [4, 14, 18]. In LMIC settings, the problem is amplified when culture capacity is weak, turnaround times are long and laboratory results are unlikely to influence initial therapy [3–7, 17]. Sierra Leone’s recent surveillance data reinforce this context. The national point prevalence survey found high inpatient antibiotic use and almost no blood culture testing, while paediatric hospital work has documented both heavy antibiotic exposure and incomplete AMS infrastructure [10, 13]. Stewardship in this setting therefore depends as much on diagnostic strengthening as on prescriber education.

Affordability and supply were a second major constraint. Two-thirds of respondents reported considering patients’ economic background before prescribing, and interviewees described patients buying only part of a prescribed regimen or being referred elsewhere when hospital stock was unavailable. These pressures alter both the choice of antibiotic and the likelihood that the intended course will be completed. In resource-constrained settings, the antibiotic selected on paper is not always the antibiotic that is obtained and taken. Evidence from Sierra Leone shows reliance on a limited group of commonly used antibiotics, high outpatient prescribing and substantial use of prolonged or non-guideline surgical

prophylaxis [8, 9, 12]. Regional evidence from West Africa likewise points to variable appropriateness and patchy stewardship implementation [15, 16]. Stewardship policy that ignores procurement, stock management and patient cost will have limited effect.

Hospital differences in reported narrow-spectrum-first prescribing should be interpreted with care. Higher reporting at PCMH and ODCH may suggest stronger adherence to first-line pathways, but it may also reflect differences in case mix, severity and service profile across adult, maternity and paediatric referral settings. Respondents described situations in which severe illness or immunosuppression justified escalation beyond first-line therapy. The point is not that broad-spectrum use is inherently inappropriate, but that stewardship needs to distinguish justified escalation from routine drift. Simple comparisons between hospitals are therefore useful for generating questions, not for ranking performance.

The study also supports a deliberately multidisciplinary view of stewardship. Nurses made up most of the respondent pool and, in exploratory modelling, were more likely than doctors to report guideline availability. Pharmacists and interviewees across cadres described medicine availability and dispensing constraints as central to antibiotic practice. Antibiotic use in hospitals is produced through distributed work: prescribing, dispensing, administration, review and follow-up [3–7]. Sierra Leone's experience at Connaught Hospital shows that stewardship can be organised through a multidisciplinary subcommittee combining education, awareness and guideline work [11]. The present findings suggest that such teams should be broadened, made more visible and used to deliver repeated case-based feedback rather than one-off sensitisation.

Several implications follow for policy and practice. Hospitals need locally credible antibiotic guidance that is easy to find and routinely used, not merely stored. Diagnostic stewardship and antimicrobial stewardship should be developed together, because microbiology access and turnaround time are stewardship interventions in their own right. Procurement and stewardship should also be linked. Reliable supply of first-line antibiotics is essential if prescribers are expected to choose them. Stewardship education should be continuous, multidisciplinary and linked to real cases, especially where junior staff learn by observing senior practice. Finally, monitoring must be feasible. Point prevalence surveys, ward-level review and simple audit-and-feedback cycles may be more realistic and more useful than complex surveillance systems that cannot be sustained [3, 10, 11]. Taken together, the study suggests that the next phase of AMS work in Sierra Leone should move beyond awareness alone and focus on the enabling conditions of better prescribing: visible local guidance, dependable diagnostics, reliable antibiotic supply, multidisciplinary review and institutional support strong enough to shift routine practice.

Strengths and limitations

This study included three tertiary referral hospitals that collectively cover adult, maternity and paediatric care, and it included three professional groups whose roles intersect in antibiotic use. The convergent

design integrated quantitative patterns and qualitative themes through a joint display comparison. This approach explicitly mapped convergence and complementarity to strengthen the interpretation of stewardship barriers. The analysis also avoided collapsing conceptually distinct Likert items into a single barrier score that would have overstated measurement precision.

Several limitations should shape interpretation. First, the survey measured self-reported practices and perceptions, not observed prescribing or clinical practice, guideline concordance or patient-level appropriateness. Second, the cross-sectional design cannot establish directionality or causation. Third, recruitment was pragmatic and the response rate was moderate, so selection and non-response bias are possible. Fourth, nurses comprised most of the sample, which reflects the hospital workforce but also influences the overall pattern of responses. Finally, the interview sample was small and designed for representation across sites and cadres rather than formal saturation, and all participating hospitals were tertiary facilities in Freetown, which may limit transferability to other settings.

Conclusions

Across three tertiary hospitals in Sierra Leone, healthcare workers reported high awareness of AMR and strong recognition of stewardship challenges, but antibiotic decisions were bounded by diagnostic scarcity, medicine availability, affordability and clinical hierarchy. These findings support a stewardship agenda built around visible local guidance, timely diagnostics, reliable supply of essential antibiotics and repeated multidisciplinary training and feedback. Improving antibiotic use in this setting will require organisational and system change, not education alone.

Abbreviations

AMR

Antimicrobial Resistance

AMS

Antimicrobial Stewardship

ASP

Antimicrobial Stewardship Programme

aOR

Adjusted Odds Ratio

CI

Confidence Interval

IQR

Interquartile Range

LMIC

Low- and Middle-Income Country

ODCH

Ola During Children's Hospital

PCMH

Princess Christian Maternity Hospital

WHO

World Health Organization

Declarations

Ethical Approval and Consent to Participate

This study was approved by the Ethics Committee of the College of Medicine and Allied Health Sciences, University of Sierra Leone (reference: COMAHS/FCS/D/30), covering all participating hospitals within the University of Sierra Leone Teaching Hospitals Complex. The research was conducted in accordance with the Declaration of Helsinki.

Consent for publication:

Not applicable.

Competing interests:

The authors declare that they have no competing interests.

Additional files

Additional file 1: Self-administered questionnaire (English language version).

Additional file 2: Key informant interview guide, including participant information sheet and consent form (English language version).

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Author Contribution

FBB conceived and designed the study and supervised data collection. MBJ performed the statistical analysis and drafted the manuscript with FBB and AKB. SFFS, AmB, AM, MMB, IPJ, AIB, OTA, and SL contributed to study design, data collection, and critical revision of the manuscript. MBJ, MB, SL, OTA,

and AKB contributed to data interpretation and critical revision of the manuscript. AKB supervised this study. All authors read and approved the final manuscript.

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Availability of data and materials:

De-identified data may be made available on reasonable request to the corresponding author, subject to institutional approval and data protection requirements.

References

1. GBD 2021 Antimicrobial Resistance Collaborators. Global burden of bacterial antimicrobial resistance 1990–2021: a systematic analysis with forecasts to 2050. *Lancet*. 2024;404:1199–226. 10.1016/S0140-6736(24)01867-1.
2. Antimicrobial Resistance Collaborators. Global burden of bacterial antimicrobial resistance in 2019: a systematic analysis. *Lancet*. 2022;399:629–55. 10.1016/S0140-6736(21)02724-0.
3. Van Dijck C, Vlieghe E, Cox JA. Antibiotic stewardship interventions in hospitals in low- and middle-income countries: a systematic review. *Bull World Health Organ*. 2018;96:266–80. 10.2471/BLT.17.203448.
4. Krockow EM, Colman AM, Chattoe-Brown E, et al. Balancing the risks to individual and society: a systematic review and synthesis of qualitative research on antibiotic prescribing behaviour in hospitals. *J Hosp Infect*. 2019;101:428–39. 10.1016/j.jhin.2018.08.007.
5. Charani E, Castro-Sánchez E, Sevdalis N, et al. Understanding the determinants of antimicrobial prescribing within hospitals: the role of 'prescribing etiquette'. *Clin Infect Dis*. 2013;57:188–96. 10.1093/cid/cit212.
6. Gebretekla GB, Haile Mariam D, Abebe W, et al. Opportunities and barriers to implementing antibiotic stewardship in low- and middle-income countries: lessons from a mixed-methods study in a tertiary care hospital in Ethiopia. *PLoS ONE*. 2018;13:e0208447. 10.1371/journal.pone.0208447.
7. Rolfe RJ Jr, Kwobah C, Muro F, et al. Barriers to implementing antimicrobial stewardship programs in three low- and middle-income country tertiary care settings: findings from a multi-site qualitative study. *Antimicrob Resist Infect Control*. 2021;10:60. 10.1186/s13756-021-00929-4.

8. Kanu JS, Khogali M, Hann K, et al. National antibiotic consumption for human use in Sierra Leone (2017–2019): a cross-sectional study. *Trop Med Infect Dis.* 2021;6:77. 10.3390/tropicalmed6020077.
9. Lakoh S, Deen GF, Bawoh M, et al. Antibiotic use and consumption in Freetown, Sierra Leone: a baseline report of prescription stewardship in outpatient clinics of three tertiary hospitals. *IJID Reg.* 2023;7:43–51. 10.1016/j.ijregi.2023.02.004.
10. Kamara IF, Kanu J, Maruta A, et al. Antibiotic use among hospitalised patients in Sierra Leone: a national point prevalence survey using the WHO survey methodology. *BMJ Open.* 2023;13:e078367. 10.1136/bmjopen-2023-078367.
11. Lakoh S, Bawoh M, Lewis H, et al. Establishing an antimicrobial stewardship programme in Sierra Leone: a report of the experience of a low-income country in West Africa. *Antibiot (Basel).* 2023;12:424. 10.3390/antibiotics12030424.
12. Lakoh S, Kanu JS, Conteh SK, et al. High levels of surgical antibiotic prophylaxis: Implications for hospital-based antibiotic stewardship in Sierra Leone. *Antimicrob Steward Healthc Epidemiol.* 2022;2(1):e111. 10.1017/ash.2022.252.
13. Kamara IF, Fofanah BD, Nuwagira I, et al. Assessment of antimicrobial stewardship programmes and antibiotic use among children admitted to two hospitals in Sierra Leone: a cross-sectional study. *Antimicrob Resist Infect Control.* 2024;13:80. 10.1186/s13756-024-01425-1.
14. Harun MGD, Sumon SA, Hasan I, et al. 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;13:8. 10.1186/s13756-024-01369-6.
15. Abubakar U, Salman M. Antibiotic use among hospitalized patients in Africa: a systematic review of point prevalence studies. *J Racial Ethn Health Disparities.* 2024;11:1308–29. 10.1007/s40615-023-01610-9.
16. Donkor ES, Oli AN, Biney RP, et al. Improving antibiotic utilization in West Africa: insights from antimicrobial stewardship programmes in Ghana, Nigeria, Senegal and Sierra Leone. *Antimicrob Resist Infect Control.* 2025;14:5. 10.1186/s13756-024-01504-3.
17. Koroma AT, Bundu PM, Sheriff M, et al. Behavioral practices towards antibiotic use among health care workers - Sierra Leone, 2021: a facility-based cross-sectional study. *Pan Afr Med J.* 2024;47:63. 10.11604/pamj.2024.47.63.39287.
18. Peiffer-Smadja N, Descousse S, Courrèges E, et al. Implementation of a clinical decision support system for antimicrobial prescribing in sub-Saharan Africa: multisectoral qualitative study. *J Med Internet Res.* 2024;26:e45122. 10.2196/45122.

Supplementary Files

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