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Awareness, Knowledge, and Perceptions of Healthcare Professionals Regarding Antimicrobial Stewardship in Four Tertiary Hospitals in Freetown, Sierra Leone

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Abstract

Background

Antimicrobial resistance (AMR) is among the most consequential threats to contemporary health systems, and its burden is borne disproportionately by low- and middle-income countries. Sierra Leone records one of the highest AMR-associated mortality rates worldwide, yet antimicrobial stewardship (AMS) remains fragmented and, in most facilities, unformalised. Because stewardship is ultimately enacted through the routine decisions of frontline clinicians, this study assessed the awareness, knowledge, perceptions and perceived barriers relating to AMS among healthcare professionals (HCPs) in four tertiary hospitals in Freetown.

Methods

A hospital-based analytical cross-sectional study was conducted between 1 June and 30 August 2025 at Ola During Children's Teaching Hospital, Connaught Teaching Hospital, Princess Christian Maternity Hospital and the Dr. Julius Maada Bio Paediatric Centre of Excellence. The sample size was derived using Cochran's formula with finite population correction against an eligible workforce of 1,478 and an allowance of 10% for non-response, yielding 339 participants, who were selected by stratified random sampling with proportional allocation by facility and professional cadre. A structured, pre-tested, self-administered questionnaire measured awareness (four items), knowledge (six items) and perception (five items); composite scores were classified using pre-specified thresholds. Data were analysed in IBM SPSS Statistics version 27 using descriptive statistics, the chi-square test and bivariate followed by multivariable logistic regression, with variables at $p < 0.20$ in bivariate analysis entered into the adjusted model. Significance was set at $p < 0.05$, and reporting follows the STROBE statement for cross-sectional studies.

Results

Of the 339 respondents, 211 (62.2%) were female and 179 (52.8%) were nurses. Although 301 (88.8%) reported having heard of AMS, only 178 (52.5%) achieved a good composite awareness score and 186 (54.9%) were familiar with the WHO Access, Watch and Reserve (AWaRe) classification. Good knowledge was demonstrated by 206 (60.8%) participants, moderate knowledge by 120 (35.4%) and poor knowledge by 13 (3.8%), and 329 (97.1%) held positive perceptions of stewardship. The barriers most frequently endorsed were limited knowledge and training (311, 91.9%), limited staff involvement (273, 80.5%), absence of an AMS policy or guideline (271, 80.0%), lack of dedicated funding (247, 72.9%), poor laboratory diagnostic support (241, 71.1%) and weak infection prevention and control infrastructure (233, 68.7%); 209 (61.7%) had received no formal AMS training in the preceding two years. In the multivariable model, male sex (versus female: adjusted odds ratio [AOR] 3.92, 95% confidence interval [CI] 1.46–10.49, $p = 0.007$) and good knowledge (versus poor knowledge: AOR 7.45, 95% CI 1.72–32.36,

p = 0.007) were independently associated with good composite AMS awareness, whereas perception was not (AOR 0.39, 95% CI 0.07–2.14, p = 0.278).

Conclusions

Exposure to antimicrobial stewardship terminology was high in Freetown's tertiary hospitals, and attitudes towards stewardship were overwhelmingly favourable; however, composite awareness and knowledge remained substantially lower than simple exposure, while implementation was constrained by deficits in training, governance, diagnostics and financing. Attitudes are overwhelmingly favourable, but composite awareness and applied knowledge remain moderate and implementation is constrained by deficits in training, governance, diagnostics and financing. Favourable attitudes constitute a usable foundation; converting them into practice will require institutionalised AMS committees and guidelines, cadre-inclusive continuing education, and investment in microbiological diagnostic capacity.

1. Introduction

Antimicrobial resistance (AMR) is one of the most pressing threats to global health, eroding decades of therapeutic progress and increasing morbidity, mortality and health expenditure across every level of care (1). Although resistance is a natural evolutionary phenomenon, the pace of its emergence is driven largely by modifiable human factors: deficient infection prevention and control, weak laboratory and surveillance systems, and the inappropriate use of antimicrobial agents in hospitals and communities alike. Inappropriate prescribing remains the single most tractable of these determinants, and it is most consequential in tertiary facilities, where antimicrobial exposure is high and treatment decisions are frequently empirical (2).

Antimicrobial stewardship (AMS) has emerged as the principal clinical response to this problem. The term denotes coordinated interventions that promote the appropriate selection, dosing, route and duration of antimicrobial therapy in order to improve patient outcomes while preserving the effectiveness of agents already in use (3). Together with infection prevention and control and antimicrobial consumption surveillance, AMS constitutes a core pillar of health system strengthening. Evidence from diverse settings indicates that well-designed stewardship programmes reduce inappropriate antibiotic use, contain costs and slow the selection of resistant organisms; their effectiveness, however, is contingent on local adaptation informed by context-specific data and on the engagement of the health workforce that implements them (2, 4).

The burden of AMR is projected to fall most heavily on low- and middle-income countries, with modelled estimates approaching ten million attributable deaths annually by 2050 in the absence of decisive action (5, 6). Sierra Leone is among the most severely affected countries, with an estimated 9,700 AMR-associated deaths in 2019 (7, 8). National policy has been aligned with the WHO Global Action Plan, yet operational implementation has lagged behind commitment (9). Although the country has begun to establish facility-level AMS structures, implementation remains uneven: a multidisciplinary AMS

subcommittee was established at the national referral hospital in 2021 (25), whereas a subsequent assessment of two other tertiary facilities found the required components of a stewardship programme to be fragmented or altogether absent (26). Successive facility-based studies in Freetown have correspondingly documented high antibiotic exposure, limited adherence to treatment guidelines and minimal use of laboratory diagnostics to inform prescribing (10, 11).

Recent developments, including the establishment and strengthening of AMS structures at selected tertiary hospitals, indicate movement in the right direction, but stewardship practice remains uneven and institutionally fragile. Crucially, the performance of an AMS programme depends not only on the presence of stewardship structures, including committees, guidelines, formularies and diagnostic services, but also on the awareness, knowledge and perceptions of the professionals who make antimicrobial decisions at the bedside, and on the system-level constraints they encounter. These individual and institutional dimensions are rarely examined together, and evidence describing them across multiple tertiary settings in Sierra Leone is scarce.

This study addresses that gap. It provides a multi-hospital assessment of AMS awareness, knowledge and perceptions among healthcare professionals in four tertiary hospitals in Freetown; it documents the barriers those professionals identify as impeding implementation; and it examines the factors independently associated with composite AMS awareness. By including all major clinical cadres involved in prescribing, dispensing, administration and laboratory diagnosis, and by measuring individual-level competence alongside system-level constraints, the study offers an integrated appraisal of stewardship readiness in Sierra Leone's tertiary sector and generates the context-specific evidence required to target training, institutional policy and multidisciplinary stewardship activity.

2. Methods

2.1 Study design and reporting

A hospital-based analytical cross-sectional study was conducted from 1 June to 30 August 2025. The study is reported in accordance with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement for cross-sectional studies.

2.2 Study setting

The study was conducted in four government-owned tertiary hospitals in Freetown, Sierra Leone: Ola During Children's Teaching Hospital (ODCH), Princess Christian Maternity Hospital (PCMH), Connaught Teaching Hospital and the Dr. Julius Maada Bio Paediatric Centre of Excellence (JMB/PCE). These facilities were selected purposively because they deliver the principal tertiary services in the capital and together employ the range of professionals involved in antimicrobial prescribing, dispensing, administration, laboratory diagnosis and infection prevention and control.

ODCH provides specialised tertiary paediatric services, including outpatient and inpatient care, emergency services, neonatal and paediatric care, and the management of complex childhood illness. PCMH is the national referral maternity hospital and the site of the National School of Midwifery, specialising in maternal, obstetric, gynaecological and neonatal services, and it carries the highest obstetric caseload in the country. Connaught Teaching Hospital is the principal adult tertiary referral and teaching hospital; it delivers medical, surgical and specialised diagnostic and therapeutic services through 25 departments and 16 wards with more than 300 beds, and it employs the largest concentration of clinical specialists nationally (27). JMB/PCE is a tertiary paediatric referral facility receiving patients from Freetown and from other regions of the country. Together these facilities serve large and diverse referral populations drawn from the Western Area and from every province of Sierra Leone.

Specialist antimicrobial expertise was distributed unevenly across the four sites. During the study period, Connaught Teaching Hospital had both an infectious-disease physician and a specialist pharmacist with clinical pharmacy responsibilities; neither cadre was present at ODCH, PCMH or JMB/PCE. This heterogeneity in specialist capacity provides an important interpretive context for the differences in awareness, knowledge, perception and perceived barriers observed across facilities.

2.3 Study population and eligibility criteria

The study population comprised healthcare professionals employed at the four participating hospitals and directly involved in antimicrobial prescribing, dispensing, administration or laboratory diagnosis: medical doctors, nurses, midwives, pharmacists, pharmacy technicians, laboratory scientists, laboratory technicians and other clinical cadres performing these functions. Eligibility was defined as follows:

- Inclusion: healthcare professionals currently employed at a participating hospital and willing to provide written informed consent.
- Exclusion: individuals who returned substantially incomplete questionnaires or who withdrew after enrolment.

2.4 Sample size determination

The sample size was calculated using Cochran's formula for a single proportion:

$$\varvec{n}_0 = \frac{\varvec{Z}^2 \, \varvec{p} \, [1 - \varvec{p}]}{\varvec{e}^2}$$

where n_0 is the initial sample size, Z is the standard normal deviate corresponding to the 95% confidence level (1.96), p is the assumed proportion and e is the margin of error (0.05). In the absence of prior comparable data from Sierra Leone, p was set at 0.50 to yield the maximum required sample:

$$\varvec{n}_0 = \frac{(1.96)^2 \times 0.5 \times 0.5}{(0.05)^2}$$

This gave n_0 = 384. Because the eligible workforce across the four facilities was finite (N = 1,478), the finite population correction was applied:

Applying finite population correction $\varvec{n} = \frac{\varvec{n}_0}{1+\frac{\varvec{n}_0-1}{\varvec{N}}}$

$$\varvec{n} = \frac{384}{1 + \frac{384-1}{1478}}$$

This gave n = 305. Allowing 10% for non-response:

$$\varvec{n}_{\varvec{final}} = \frac{305}{0.9} = 339$$

The final target sample was therefore 339 participants, all of whom were successfully enrolled.

2.5 Sampling procedure

Participants were selected by stratified random sampling to ensure proportional representation across facilities and professional cadres. Strata were defined by professional cadre (doctors, nurses, pharmacists and pharmacy technicians, and laboratory staff) within each facility, and the number of participants drawn from each stratum was determined by proportional allocation:

$$\varvec{n}\varvec{h} = \frac{\varvec{N}\varvec{h}}{\varvec{N}} \times \varvec{n}$$

where n_h is the number of participants allocated to stratum h, N_h is the number of eligible professionals in that stratum, N is the total eligible workforce (1,478) and n is the total sample size (339). Within each stratum, participants were selected at random from facility staff registers. The resulting distribution was 122 (35.9%) from JMB/PCE, 108 (31.8%) from PCMH, 82 (24.2%) from Connaught Teaching Hospital and 27 (8.0%) from ODCH.

2.6 Data collection instrument and procedure

A structured, pre-tested, self-administered questionnaire was used. The instrument was adapted from previously developed and published surveys assessing healthcare professionals' knowledge, awareness and perceptions of antimicrobial stewardship and related antibiotic-use practices (13, 15, 16), all of which predate the present study, and comprised five sections: socio-demographic characteristics, awareness of AMS, knowledge of AMS principles, perceptions of AMS, and perceived barriers to implementation.

Prior to the main survey, the questionnaire was pre-tested among 20 healthcare professionals (10 doctors and 10 nurses) at a non-participating hospital. These cadres were chosen for the pre-test because they are directly engaged in prescribing, clinical decision-making and patient management and were therefore best placed to appraise the clinical relevance, clarity and comprehensibility of the items. The pre-test examined wording, comprehension, the appropriateness of response options and the overall flow of the instrument; items identified as ambiguous were revised before administration. Pre-test data were not included in the analysis.

Internal consistency of the multi-item domains was assessed using Cronbach's alpha and was acceptable for the knowledge domain ($\alpha = 0.78$) and good for the perception domain ($\alpha = 0.81$). Reliability was examined at domain level rather than by cadre, since the objective was to establish the coherence of the measurement domains rather than to compare subgroup reliabilities.

Data were collected by trained research assistants in wards, clinics and staff lounges in order to reach eligible participants during working hours. Research assistants explained the study, obtained written informed consent and distributed the questionnaire for self-completion. Completed questionnaires were checked for completeness at the point of collection and before data entry.

2.7 Measurement and classification of outcome variables

Awareness of AMS was assessed using four predefined items addressing participants' exposure to and recognition of key AMS concepts and structures. The composite awareness measure was operationalised as an index rather than a validated psychometric scale. Each awareness-consistent response was assigned one point and each awareness-inconsistent response zero points. The four items and response key are provided in Supplementary Table S1. Total scores were converted to percentages, with scores ≥ 50% classified as good awareness and scores < 50% as poor awareness, consistent with previous studies applying composite awareness measures among healthcare professionals in comparable settings. (15). Self-reported exposure to the term "antimicrobial stewardship" was recorded separately as a single item and is reported distinctly from the composite score throughout.

Knowledge was assessed with six items, with one point assigned to each correct response and zero to incorrect or uncertain responses. Total scores were converted to percentages and categorised using Bloom's cut-off criteria as good (80–100%), moderate (60–79%) or poor (< 60%) (13).

Perception was assessed with five items, with one point awarded for each favourable response. Scores ranged from 0 to 5; a pre-specified majority-positive criterion was used to classify scores of 3–5 as positive perception and 0–2 as negative perception. Similar binary scoring approaches have been used in healthcare knowledge, attitude and practice studies (14).

Perceived barriers were captured through a multiple-response item in which participants could endorse any number of listed constraints; percentages for this item are therefore reported as the proportion of the 339 respondents endorsing each barrier and do not sum to 100%.

2.8 Data management and statistical analysis

Data were coded, entered, cleaned and analysed in IBM SPSS Statistics version 27. Categorical variables were summarised as frequencies and percentages. Associations between socio-demographic characteristics and composite awareness were examined using the chi-square test. Bivariate logistic regression was used to estimate crude odds ratios (CORs) with 95% confidence intervals, and variables associated with the outcome at $p < 0.20$ were entered into a multivariable logistic regression model to obtain adjusted odds ratios (AORs). Model performance was assessed using the Hosmer-Lemeshow goodness-of-fit test, and multicollinearity was examined through variance inflation factors. Statistical significance was set at $p < 0.05$.

3. Results

3.1 Socio-demographic characteristics of participants

All 339 sampled healthcare professionals completed the questionnaire, giving a response rate of 100%. Most participants were female (211, 62.2%), and the largest age group was 25–34 years (149, 44.0%). Nurses formed the largest professional group (179, 52.8%), followed by medical doctors (51, 15.0%), pharmacists (31, 9.1%) and pharmacy technicians (29, 8.6%). Two-fifths of respondents (137, 40.4%) had between one and five years of practice experience, and a further 77 (22.7%) had less than one year. Paediatrics (96, 28.3%) and inpatient wards (82, 24.2%) were the most commonly reported units of practice (Table 1).

Table 1
Socio-demographic characteristics of healthcare professionals (N = 339)

Variable	Responses	Frequency (N = 339)	Percent (%)
Gender of Participants	Male	128	37.8
	Female	211	62.2
Age Group (Years)	18–24	58	17.1
	25–34	149	44.0
	35–44	92	27.1
	45–54	32	9.4
	55 or Older	8	2.4
Profession of Participants	Medical doctor	51	15.0
	Nurse	179	52.8
	Pharmacist	31	9.1
	Laboratory scientist	24	7.1
	Pharmacy technician	29	8.6
	Laboratory technician	16	4.7
	Other	9	2.7
Years of Experience in Healthcare Practice	< 1 Year	77	22.7
	1–5 Years	137	40.4
	6–10 Years	64	18.9
	11–15 Years	32	9.4
	> 15 Years	29	8.6
Current Department/Unit	Outpatient	27	8.0
	Inpatient/Ward	82	24.2
	Pediatrics	96	28.3
	Surgery	17	5.0
	Maternity	12	3.5

Note: the "Other" category (n = 9, 2.7%) comprises eligible clinical cadres not listed separately, principally midwives and community health officers involved in antimicrobial administration or dispensing.

Variable	Responses	Frequency (N = 339)	Percent (%)
	Laboratory	35	10.3
	Pharmacy	54	15.9

Note: the "Other" category (n = 9, 2.7%) comprises eligible clinical cadres not listed separately, principally midwives and community health officers involved in antimicrobial administration or dispensing.

3.2 Awareness of antimicrobial stewardship

Self-reported exposure to AMS was high: 301 respondents (88.8%) had heard of the concept, most commonly through medical training programmes (214, 63.1%), followed by colleagues (48, 14.2%) and social media (38, 11.2%). Awareness of an AMS programme or team within the respondent's own facility was reported by 232 (68.4%), while 65 (19.2%) were unaware of any such structure and 42 (12.4%) were uncertain. Familiarity with the WHO Access, Watch and Reserve (AWaRe) classification was reported by 186 respondents (54.9%), and 130 (38.3%) had received formal AMS training within the preceding two years (Table 2).

When the four awareness items were combined into the pre-specified composite score, 178 participants (52.5%) were classified as having good awareness (score ≥ 50%) and 161 (47.5%) as having poor awareness (score < 50%). The apparent discrepancy between this figure and the 88.8% who reported having heard of AMS reflects the fact that the two measures quantify different things and are not alternative estimates of the same quantity. The 88.8% derives from a single dichotomous item capturing self-reported exposure to the term, whereas the 52.5% is a composite of four items that assess recognition of institutional stewardship structures, familiarity with the WHO AWaRe classification and receipt of formal AMS training. Respondents could therefore report having heard of AMS while failing at least half of the composite items, and at least 123 respondents (36.3% of the sample) fell into this category at minimum: familiar with the term but below the composite threshold. (Fig. 1).

Table 2
Awareness of healthcare professionals toward antimicrobial stewardship

Variable	Response	Frequency (N = 339)	Percent (%)
Have you ever heard of antimicrobial stewardship (AMS)?	Yes	301	88.8
	No	38	11.2
Sources of information about AMS	Medical training programs	214	63.1
	Social media	38	11.2
	Colleagues	48	14.2
	Others	39	11.5
Are you aware of the Existence of an AMS program or team in your hospital?	Yes	232	68.4
	No	65	19.2
	Not sure	42	12.4
Are you familiar with the WHO's Access, Watch, and Reserve (AWARE) classification for antibiotics?	Yes	186	54.9
	No	112	33.0
	Not sure	41	12.1
Have you received any formal training on AMS in the past 2 years?	Yes	130	38.3
	No	209	61.7

3.3 Knowledge of antimicrobial stewardship

Overall, 206 (60.8%) participants demonstrated good knowledge, 120 (35.4%) moderate knowledge, and 13 (3.8%) poor knowledge (Fig. 2). Most participants correctly identified that AMS promotes appropriate antimicrobial use (95.3%) and reduces antimicrobial resistance (93.8%). Furthermore, 79.1% correctly rejected the notion that AMS is solely the responsibility of doctors. Knowledge was less consistent regarding guideline-directed empirical therapy (68.7%) and the use of broad-spectrum antibiotics for all infections (56.3% correctly rejected this statement). Overall, 77.6% correctly indicated that blood cultures should be obtained before initiating antibiotics (Table 3) (Table 3).

Table 3
Knowledge of healthcare professionals on antimicrobial stewardship

Knowledge item	True n (%)	False n (%)	Not sure n (%)
AMS promotes the appropriate use of antimicrobials	323 (95.3)	3 (0.9)	13 (3.8)
AMS helps reduce antimicrobial resistance	318 (93.8)	9 (2.7)	12 (3.5)
AMS is solely the responsibility of doctors	27 (8.0)	268 (79.1)	44 (13.0)
Empirical antibiotic use should be guided by local treatment guidelines	233 (68.7)	57 (16.8)	49 (14.5)
Broad-spectrum antibiotics are preferred for all infections	98 (28.9)	191 (56.3)	50 (14.7)
Blood cultures should be obtained before initiating antibiotics	263 (77.6)	31 (9.1)	45 (13.3)

Note: Values are based on the total sample (N = 339). For negatively worded items, the False response represents the correct knowledge response.

3.4 Perceptions of antimicrobial stewardship

Perceptions were almost uniformly favourable, with 329 participants (97.1%) classified as holding a positive perception of AMS. At item level, 331 (97.6%) agreed that AMS programmes are important in healthcare settings, 309 (91.2%) that stewardship improves rational antibiotic prescribing and 308 (90.9%) that it improves patient outcomes. A high proportion, 299 (88.2%), expressed confidence in participating in stewardship activities, and 318 (93.8%) supported the incorporation of AMS training into professional education (Fig. 3, Table 4).

Table 4
Perceptions of healthcare professionals toward antimicrobial stewardship

Perception item	Agree n (%)	Neutral n (%)	Disagree n (%)
AMS programmes are important in healthcare settings	331 (97.6)	7 (2.0)	1 (0.3)
Implementing AMS can improve patient outcomes	308 (90.9)	14 (4.1)	17 (5.0)
AMS improves rational antibiotic prescribing	309 (91.2)	15 (4.4)	15 (4.4)
I feel confident participating in AMS activities	299 (88.2)	35 (10.3)	5 (1.5)
AMS training should be included in professional education	318 (93.8)	16 (4.7)	4 (1.2)

3.5 Perceived barriers to AMS implementation

Respondents identified multiple, overlapping constraints on stewardship implementation. Limited knowledge and training was the most frequently endorsed barrier (311, 91.9%), followed by limited staff involvement (273, 80.5%), the absence of an AMS policy or guideline (271, 80.0%), lack of dedicated funding (247, 72.9%), poor laboratory diagnostic support (241, 71.1%) and weak infection prevention and control infrastructure (233, 68.7%). Time constraints and patient pressure to prescribe antibiotics were each reported by 158 respondents (46.6%). The pattern indicates that the principal impediments identified by staff are institutional and resource-related rather than attitudinal (Table 5).

Table 5
Perceived barriers to antimicrobial stewardship implementation

Variable	Response	Frequency	Percent (%)
What are the main challenges to AMS implementation at your hospital?	Lack of AMS policy or guidelines	271	80.0
	Limited knowledge/training	311	91.9
	Poor lab diagnostic support	241	71.1
	Time constraints	158	46.6
	Limited staff involvement	273	80.5
	Patient pressure to prescribe antibiotics	158	46.6
	Poor infection prevention and control (IPC) infrastructure	233	68.7
	Lack of funding for AMS	247	72.9

Note: multiple responses were permitted; percentages represent the proportion of the 339 respondents endorsing each barrier and therefore do not sum to 100%.

3.6 Factors associated with composite AMS awareness

The outcome variable in all regression models was the dichotomised composite awareness score, coded as good composite awareness (score ≥ 50%; n = 178) versus poor composite awareness (score < 50%; n = 161), with poor awareness as the reference category of the outcome. Gender, overall knowledge category and overall perception met the $p < 0.20$ threshold in bivariate analysis and were entered into the multivariable model. After adjustment, male respondents had approximately fourfold higher odds of good composite awareness than female respondents (COR 4.56, 95% CI 1.73–12.01; AOR 3.92, 95% CI 1.46–10.49; $p = 0.007$). Knowledge category was also independently associated with good composite awareness: compared with participants classified as having poor knowledge, those with good knowledge had substantially higher odds of good composite awareness (COR 14.86, 95% CI 4.43–49.84; $p < 0.001$; AOR 7.45, 95% CI 1.72–32.36; $p = 0.007$), whereas moderate knowledge was not significantly different from poor knowledge (AOR 1.94, 95% CI 0.91–4.15; $p = 0.086$). Perception was associated with

awareness in the crude model but not after adjustment (AOR 0.39, 95% CI 0.07–2.14; p = 0.278). The wide confidence interval for the good-knowledge estimate reflects the small number of participants in the poor-knowledge reference category (n = 13) and warrants cautious interpretation (Table 6).

Table 6
Bivariate and multivariable logistic regression analysis of factors associated with good composite AMS awareness (outcome variable: good composite awareness, score ≥ 50%, versus poor composite awareness, score < 50%)

Variables	Sub-variables	COR	*P-value*	AOR	*P-value*
		95% CI		95% CI	
Gender	Female	1		1	
	Male	4.561 (1.732–12.010)	**0.002**	3.919 (1.464–10.494)	**0.007**
Overall knowledge	Poor knowledge	1		1	
	Moderate knowledge	1.959 (0.931–4.122)	0.076	1.944 (0.911–4.148)	0.086
	Good knowledge	14.856 (4.428–49.841)	**< 0.001**	7.449 (1.715–32.359)	**0.007**
Overall Perception	Positive perception	1		1	
	Negative perception	0.111 (0.031–0.405)	**0.001***	0.391 (0.072–2.135)	0.278

Note: The dependent variable was good composite AMS awareness (score ≥ 50%), with poor composite awareness (< 50%) as the reference category. Reference categories for the independent variables were female (gender), poor knowledge (knowledge) and positive perception (perception). COR, crude odds ratio; AOR, adjusted odds ratio; CI, confidence interval.

4. Discussion

The central finding of this study is a dissociation between familiarity and competence. Nearly nine in ten healthcare professionals in Freetown's tertiary hospitals reported having heard of antimicrobial stewardship, and almost all regarded it favourably, yet only half achieved a good score on a composite measure of awareness and three in five demonstrated good knowledge of stewardship principles. This matters because stewardship is not enacted by recognition of a term but by specific decisions whether to obtain a culture before initiating therapy, whether to select a narrow- rather than broad-spectrum agent, whether to review and de-escalate and it is precisely on these applied items that performance fell away. Interpreting high exposure as evidence of stewardship readiness would therefore overstate the capacity of these institutions, and would misdirect investment toward sensitisation when the deficit lies in applied competence and in the systems required to support it.

The distinction between exposure, composite awareness and knowledge is analytically important and is maintained throughout this paper, since the coexistence of an 88.8% and a 52.5% figure for “awareness” is otherwise liable to be read as an inconsistency. It is not. Exposure captures only whether a professional has encountered the term antimicrobial stewardship; the composite score aggregates four items that also interrogate recognition of institutional stewardship structures, familiarity with the WHO AWaRe classification and receipt of recent training; and the knowledge domain measures understanding of stewardship principles and practices. Each successive measure imposes a more demanding criterion, so the proportion classified as adequate declines as the criterion tightens (88.8% reporting exposure, 60.8% good knowledge, 52.5% good composite awareness); this ordering is the expected pattern rather than a contradiction. The magnitude of the gap is nonetheless the substantive finding: more than a third of respondents recognised the term but did not meet the composite threshold, which indicates that exposure has diffused considerably further than the operational understanding on which stewardship depends. Single-item measures of AMS awareness may therefore overestimate stewardship readiness and should be interpreted cautiously when used as proxies for operational competence.

Awareness of institutional stewardship structures was noticeably lower than awareness of the concept in the abstract. Although 68.4% of respondents reported that an AMS programme or team existed in their facility, nearly one-third were either unaware of such a structure (19.2%) or uncertain whether one existed (12.4%). Two readings are possible and are not mutually exclusive: that stewardship structures are genuinely absent in several of these facilities, which is consistent with the documented national picture in which formal programmes are the exception; and that where committees do exist, their activities are insufficiently visible to the wider clinical workforce. The uneven distribution of specialist capacity across the four sites supports the first reading, while the finding that 61.7% had received no AMS training in the preceding two years supports the second. Familiarity with the AWaRe classification, a practical framework directly applicable at the point of prescribing, was reported by only 54.9% of respondents, reinforcing the conclusion that stewardship has yet to be operationalised at ward level.

These patterns are consistent with findings from comparable settings. In Nigeria, fewer than half of surveyed healthcare workers could correctly define AMS and most were unfamiliar with the AWaRe classification (15). In Ghana, a multicentre survey found substantial knowledge deficits despite widespread acknowledgement of the importance of stewardship (16).

The Sierra Leonean evidence base, though small, permits a closer comparison and is largely concordant with the present findings. In a national facility-based survey of 337 healthcare workers, Koroma and colleagues reported that approximately half demonstrated good knowledge of antibiotic use and just under half held positive attitudes, but only 45% achieved a good prescribing-practice score, and 83% reported prescribing antibiotics without microbiological testing (23). The proportions of participants classified as having good composite awareness (52.5%) and good knowledge (60.8%) were within a similar range to those reported in previous Sierra Leonean studies, and the diagnostic constraint identified in that study corresponds directly to the 71.1% of our respondents who cited poor laboratory support as a barrier. Kabba and colleagues found, in a national survey of doctors in outpatient

departments, that sound knowledge and favourable attitudes coexisted with irrational prescribing patterns, and concluded that audit-and-feedback stewardship programmes were required to close that gap (22) a conclusion the present data reinforce, since our respondents combined near-universal positive perception (97.1%) with substantial deficits in applied knowledge. The same disjunction between intention and practice is visible in facility-level data: antibiotic use among hospitalised adults in Freetown has been documented in settings with minimal laboratory infrastructure (24), fewer than 11% of outpatient prescriptions in three tertiary hospitals were supported by laboratory testing (11), a national point-prevalence survey found high antibiotic exposure among inpatients (7), and antibiotic consumption at national level has risen without corresponding growth in diagnostic capacity (10, 21). Taken together, this literature indicates that the constraint in Sierra Leone has been consistent across a decade of study and across cadres, facilities and levels of care: knowledge and attitudes are moderate to good, while the diagnostic, governance and training infrastructure needed to convert them into guideline-concordant prescribing remains absent. The present study extends that evidence in two respects. It extends the existing Sierra Leone evidence by disaggregating self-reported exposure from a composite awareness measure across four tertiary facilities and multiple healthcare professional cadres, and it demonstrates that the deficit is not confined to prescribers: nurses, pharmacy and laboratory staff, who constituted 82.3% of this sample, show the same pattern, which matters because stewardship in facilities without infectious-disease specialists depends on precisely these cadres.

The knowledge findings warrant particular attention because they identify where remediation should be targeted. Recognition of what stewardship is for was near-universal, with more than 93% of participants correctly identifying its role in promoting appropriate use and containing resistance. Applied knowledge was considerably weaker. More than a quarter of respondents (28.9%) endorsed the use of broad-spectrum agents for all infections, and almost one in five did not affirm the primacy of local treatment guidelines in empirical therapy. Most strikingly, 79.1% correctly rejected the proposition that antimicrobial stewardship is solely a medical responsibility, although 8.0% endorsed this view and 13.0% were uncertain. This finding nevertheless highlights the need to reinforce the multidisciplinary nature of AMS, particularly among cadres who may have limited exposure to formal stewardship activities, a belief that, if held by nurses, pharmacists and laboratory staff, structurally excludes the very cadres whose participation makes stewardship feasible in facilities without dedicated infectious-disease physicians. Comparable misconceptions have been described among nurses in China, where a substantial minority were unaware of their stewardship role (18), and in Qatar, where nurses identified the absence of formal education as the principal barrier to participation (17). The Ghanaian experience, in which structured training improved both knowledge and prescribing behaviour, suggests that these deficits are tractable through continuing professional development (19).

Against this background, the perception results are the most encouraging element of the study. With 97.1% of respondents holding positive perceptions and 93.8% endorsing the inclusion of AMS in professional curricula, resistance to stewardship as a concept is not the obstacle in this setting. Favourable attitudes typically precede behavioural change and can be mobilised rapidly once structural constraints are relieved. This mirrors evidence from Zambia, where high awareness and good practice

coexisted with functional multidisciplinary stewardship teams (20), and from Nigeria and Ghana, where professionals with limited knowledge nonetheless expressed willingness to engage given training and institutional support (12, 16). The implication for Sierra Leone is that the binding constraint is institutional rather than attitudinal.

The barrier profile reported by participants substantiates this interpretation. The four most frequently endorsed constraints training deficits, limited staff involvement, absent policies and inadequate funding are all amenable to administrative and policy action, and the two diagnostic constraints (laboratory support and IPC infrastructure) require capital investment rather than persuasion. Time pressure and patient demand, each reported by 46.6% of respondents, indicate an additional behavioural dimension in which prescribing is shaped by consultation conditions and patient expectation. Similar constellations of constraint have been reported across sub-Saharan Africa, where the absence of guidelines, weak laboratory capacity and the lack of ring-fenced stewardship funding recur as the dominant impediments (15, 19), and within Sierra Leone, where the proportion of prescriptions supported by microbiological testing has been shown to be very low (11, 21).

Two factors were independently associated with good composite AMS awareness. The association with male sex (AOR 3.92, 95% CI 1.46–10.49; p = 0.007) should be interpreted with caution rather than as evidence of a sex effect per se: sex is closely correlated with cadre in this workforce, with women concentrated in nursing and midwifery and men over-represented among physicians and pharmacists, the cadres that receive the most AMS exposure during training. The most plausible interpretation is that the estimate is partially confounded by professional role and by differential access to continuing education, and this hypothesis is directly testable in future analyses stratified by cadre. Knowledge category was also independently associated with composite awareness. Participants with good knowledge had substantially higher odds of good composite AMS awareness than those with poor knowledge (AOR 7.45, 95% CI 1.72–32.36; p = 0.007). The wide confidence interval indicates substantial imprecision around this estimate, reflecting the small size of the poor-knowledge reference group (n = 13). The observed association is plausible given the conceptual relationship between the two constructs; however, the magnitude of the association should be interpreted cautiously, and the finding should be interpreted as an association rather than evidence that knowledge causes greater awareness, particularly given the cross-sectional design. That perception was associated with awareness in the crude model but lost significance after adjustment reinforces the same conclusion: goodwill is abundant and does not distinguish between the aware and the unaware, whereas knowledge does. Similar findings have been reported in Ghana, where prior AMS training was associated with good knowledge and awareness (16), and in Zambia, where the presence of functional multidisciplinary teams was associated with stronger stewardship practice (20).

These results carry three practical implications. First, stewardship training in Sierra Leone should be cadre-inclusive rather than physician-centric, and should be structured as recurrent continuing professional development rather than one-off sensitisation, with explicit attention to spectrum selection, guideline-based empirical therapy and pre-treatment culture. Second, stewardship requires

institutionalisation: functioning committees with defined terms of reference, locally adapted treatment guidelines, and visible ward-level activity, since a committee unknown to two-fifths of the clinical workforce cannot influence prescribing. Third, investment in microbiological diagnostic capacity is a precondition rather than an adjunct, because guideline-concordant prescribing cannot be sustained where culture and susceptibility testing are unavailable to inform de-escalation.

Several limitations qualify these findings. The cross-sectional design permits the identification of associations but not causal inference, and the direction of the relationship between knowledge and awareness cannot be established. Reliance on self-reported data introduces the possibility of social desirability and recall bias, particularly for items on training receipt and confidence in stewardship participation; the near-universal endorsement of favourable perception statements is consistent with such an effect, and reported perceptions should not be assumed to correspond to observed practice. Awareness and knowledge constructs overlap, which limits the interpretability of the association between them. The multivariable model included a limited number of covariates, and the poor-knowledge reference category contained only 13 participants, resulting in wide confidence intervals and imprecise estimates for comparisons involving this group. Larger studies would allow more stable estimates and adjustment for additional factors, including professional cadre, facility, years of experience and training exposure. Finally, the study was conducted in four tertiary facilities in the capital, where staffing, supervision and diagnostic capacity exceed those of secondary and primary facilities, so the findings should not be extrapolated to district or rural settings, where stewardship capacity is likely to be weaker. These constraints notwithstanding, the study provides a multi-facility baseline of stewardship readiness among healthcare professionals in four tertiary hospitals in Sierra Leone.

5. Conclusion

Healthcare professionals in Freetown’s tertiary hospitals are widely familiar with antimicrobial stewardship and almost uniformly supportive of it, but familiarity and positive perceptions substantially exceed applied competence: only half demonstrated good composite awareness, three in five demonstrated good knowledge, and fewer than two in five had received formal AMS training in the preceding two years. Although most participants recognised AMS as a multidisciplinary responsibility, important knowledge gaps and substantial institutional barriers remain, particularly limited training, inadequate policy and guideline support, insufficient funding, and poor laboratory diagnostic capacity. Strengthening AMS in Sierra Leone will require recurrent, cadre-inclusive training, institutionalisation of functional AMS committees and locally adapted guidelines, and sustained investment in microbiological diagnostic capacity, accompanied by monitoring of antimicrobial use and stewardship outcomes.

Declarations

Ethical approval and consent to participate:

Ethical approval was obtained from the Directorate of Research and Development, Njala University Ethics Committee under the number 14/R&D,NU/2025, and permission to conduct the study was granted by the medical superintendent of each participating hospital. All procedures involving human participants were conducted in accordance with relevant ethical guidelines and regulations, including the principles of the Declaration of Helsinki. Written informed consent was obtained from every participant. Participation was voluntary, no personal identifiers were recorded, and confidentiality was maintained at all stages of data handling and analysis.

Consent for publication:

Not Applicable. No identifying images or personal or clinical details of individual participants are presented in this manuscript.

Competing interests:

The authors declare that they have no competing interests.

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Author Contribution

Conceptualisation: UB, TTS and NMK. Data acquisition: UB, NMK, ASVK and TTS. Methodology: UB, ASVK and NMK. Formal analysis and data analysis: NMK and ASVK. Visualisation: DJS, NMK, UB, AB and TTS. Writing, review and editing: UB, NMK, ASVK, DJS, AB and TTS. All authors have read and approved the final version of the manuscript and agree to be accountable for all aspects of the work.

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Data availability:

The datasets generated and analysed during the current study are available from the corresponding author on reasonable request.

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Figures

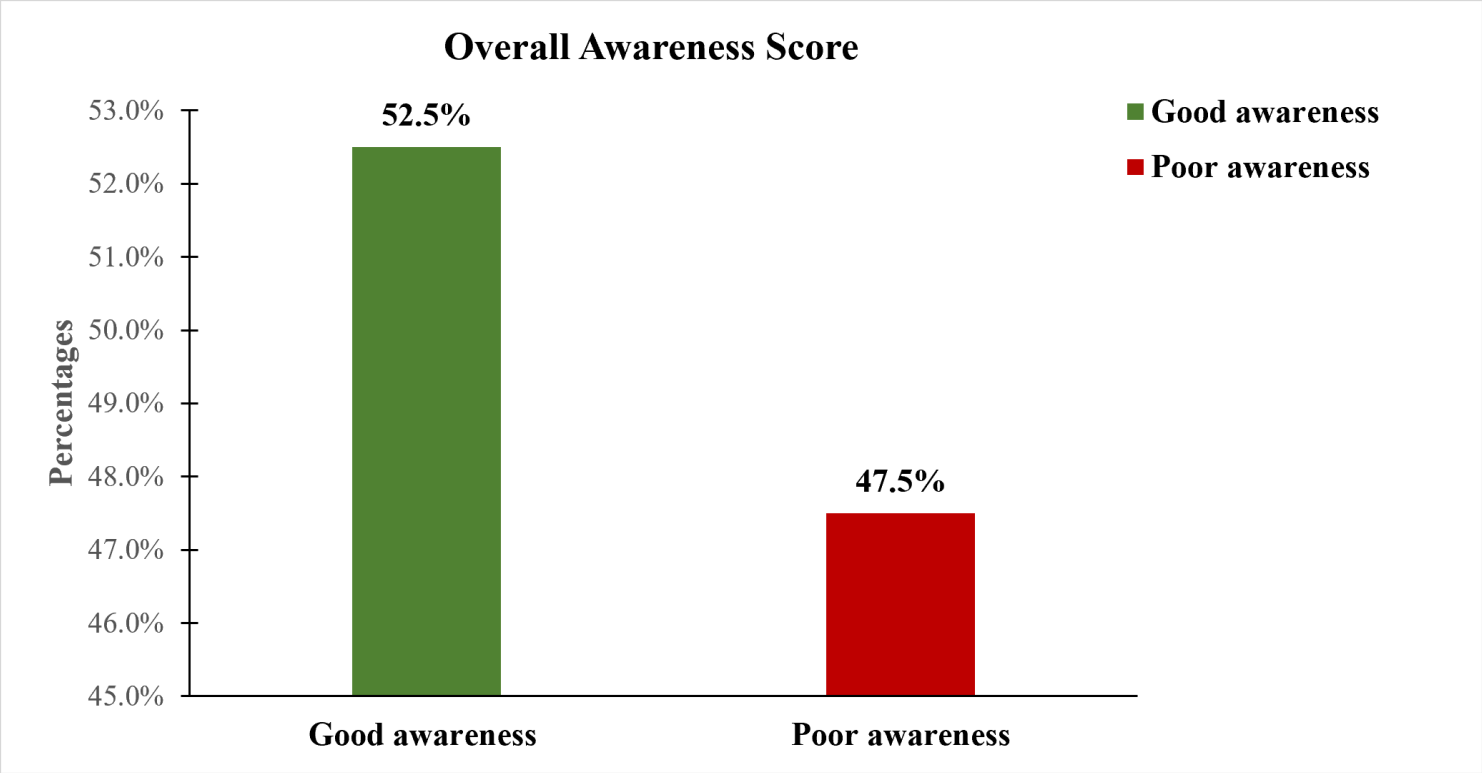


Figure 1

Composite awareness of antimicrobial stewardship among healthcare professionals (N = 339)

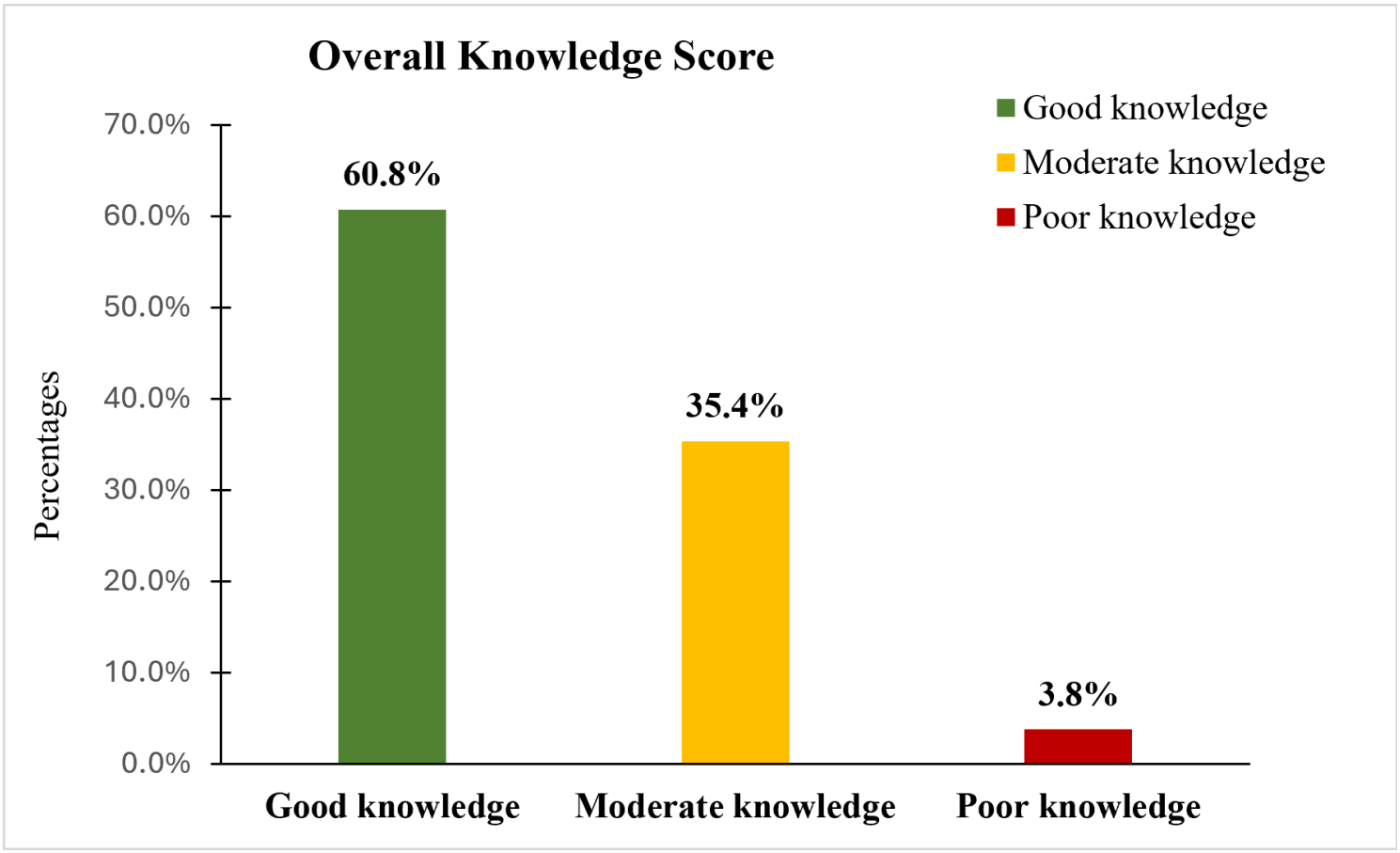


Figure 2

Overall knowledge of antimicrobial stewardship among healthcare professionals (N = 339)

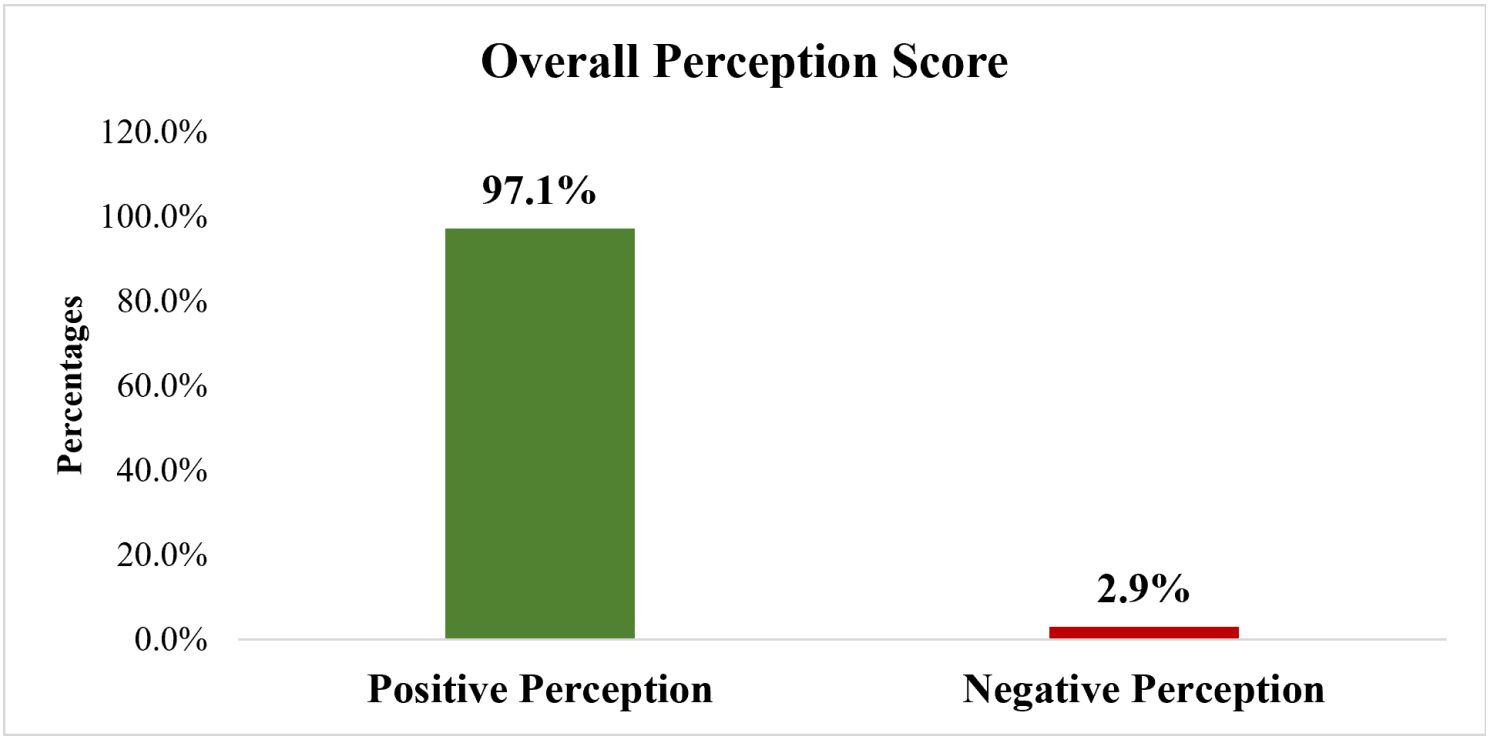


Figure 3

Perceptions of healthcare professionals toward antimicrobial stewardship (N = 339)

Supplementary Files

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- SupplementaryTableS1AMS.docx