



Research Article

Knowledge, Attitude, and Practice Regarding Antimicrobial Stewardship Among Healthcare Professionals: A Cross-Sectional Study

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Abstract: Background: Antimicrobial resistance poses a significant global health threat, making antimicrobial stewardship (AMS) programs essential. Healthcare professionals play a pivotal role in the success of these programs. **Objective:** To assess the knowledge, attitude, and practice (KAP) regarding antimicrobial stewardship among healthcare professionals. **Methods:** A cross-sectional study was conducted among 312 healthcare professionals using a validated self-administered questionnaire. Data were analyzed using SPSS version 26.0. **Results:** Of 462 distributed questionnaires, 312 were completed (67.5% response rate). Overall, 68.3% of participants demonstrated adequate knowledge, 71.5% had positive attitudes, and 54.2% reported good practices regarding antimicrobial stewardship. Pharmacists had the highest knowledge levels (77.9%), physicians led in positive attitudes (77.4%) and good practices (59.4%), while nurses scored lowest across all domains. Workload (67.1%) and missing guidelines (44.1%) were key barriers to good practice. **Conclusion:** While knowledge and attitudes toward AMS were relatively favorable, practice gaps remain evident. Targeted interventions and continuous education are warranted to bridge the knowledge-practice divide.

Keywords: Antimicrobial stewardship, knowledge, attitude, practice, healthcare professionals, antimicrobial resistance.

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INTRODUCTION

Antimicrobial resistance (AMR) has emerged as one of the most formidable public health challenges of the twenty-first century. The World Health Organization has repeatedly underscored the urgency of coordinated global action, warning that without decisive intervention, AMR could precipitate a post-antibiotic era where common infections become untreatable. [1] The causes of resistance are multifaceted from agricultural misuse, environmental contamination, and irrational prescribing practices within clinical settings. [2]

In this context, antimicrobial stewardship (AMS) programs have gained considerable traction as a cornerstone strategy for preserving the efficacy of existing antimicrobials. These programs, with a range of interventions designed to optimize antimicrobial use, are only effective if the professionals implement them. [3] Physicians, pharmacists, and nurses constitute the frontline triad in any stewardship initiative; their collective knowledge, attitudes, and daily practices ultimately determine whether guidelines translate into patient outcomes.

Despite the growing literature on AMS, significant heterogeneity persists in how healthcare professionals across different regions and institutions perceive and engage with stewardship principles. Several studies from high-income settings have reported reasonable awareness among clinicians, yet data from developing and transitional healthcare systems remain comparatively sparse. Moreover, the well-documented 'knowing-doing gap' — wherein professionals possess adequate knowledge yet fail to translate it into practice. [4,5]. Understanding the baseline KAP profile of healthcare professionals is therefore not merely an academic exercise; it is a prerequisite for designing specific educational interventions and policy reforms. The present study was undertaken to evaluate the knowledge, attitude, and practice regarding antimicrobial stewardship among healthcare professionals.

MATERIALS AND METHODS

2.1 Study Design

This cross-sectional study was conducted over a three-month period (January 2026 to March 2026).

2.2 Study Population and sample size

The study included physicians (residents and consultants), pharmacists, and nurses. The sample size was calculated using the formula for estimating a population proportion, 75% prevalence of adequate knowledge from study conducted by Pulijala S et.al, [6] 95% confidence level, and 5% margin of error, yielding a required sample of 312.

2.3 Data Collection Instrument

Data were collected using a structured, self-administered questionnaire adapted from previously validated instruments through google form [7,8] The questionnaire comprised four sections:

Section A: Sociodemographic and professional characteristics (age, gender, designation, years of experience, department).
 Section B: Knowledge domain (20 items) covering antimicrobial resistance mechanisms, spectrum of activity, de-escalation principles, and institutional guidelines. Each correct response scored 1 point; incorrect or 'don't know' responses scored 0. Knowledge was categorized as adequate ($\geq 60\%$ score) or inadequate ($< 60\%$).

Section C: Attitude domain (15 items) assessed on a 5-point Likert scale (1 = strongly disagree to 5 = strongly agree). A mean score ≥ 3.5 was considered positive.

Section D: Practice domain (12 items) evaluating self-reported behaviors such as adherence to institutional antibiograms, participation in restriction protocols, and documentation of antimicrobial indications. Responses were rated on a 4-point frequency scale; scores $\geq 75\%$ were classified as good practice.

2.4 Data Collection Procedure

Following institutional ethics approval, Google form with questionnaires were sent to health care Professionals through WhatsApp groups and other social media health professional channels.

2.5 Statistical Analysis

Data were entered into Microsoft Excel and analyzed using SPSS version 26.0 (IBM Corp., Armonk, NY). Categorical variables were summarized as frequencies and percentages, while continuous variables were expressed as means with standard deviations or medians with interquartile ranges, as appropriate. The Chi-square test was used to examine associations between sociodemographic variables and KAP outcomes.

RESULTS

3.1 Sociodemographic Characteristics

312 complete responses were recieved. The mean age of respondents was 34.6 ± 8.2 years, and 58.3% (n = 182) were female. Physicians constituted the largest professional group (42.6%, n = 133), followed by nurses (35.6%, n = 111) and pharmacists (21.8%, n = 68). The majority (54.8%, n = 171) had 1–5 years of clinical experience, while 23.4% (n = 73) had more than ten years. Departmental distribution was relatively even, with the largest representation from internal medicine (28.2%, n = 88) and the smallest from obstetrics and gynecology (8.3%, n = 26).

Table 1. Sociodemographic and professional characteristics of study participants (n = 312)

Characteristic	n	%
Age (years)		
20–30	118	37.8
31–40	97	31.1
41–50	62	19.9
>50	35	11.2
Gender		
Male	130	41.7
Female	182	58.3
Professional designation		
Physician	133	42.6
Nurse	111	35.6
Pharmacist	68	21.8
Years of clinical experience		
<1 year	28	9.0
1–5 years	171	54.8
6–10 years	40	12.8

>10 years	73	23.4
Department		
Internal Medicine	88	28.2
Surgery	72	23.1
Pediatrics	65	20.8
Intensive Care Unit	61	19.6
Obstetrics & Gynecology	26	8.3
Total	312	100

3.2 Knowledge Regarding Antimicrobial Stewardship

Table 2 shows the knowledge scores regarding antimicrobial stewardship across professional categories ($N = 312$), where overall, more than two-thirds of the study participants demonstrated adequate knowledge (68.3%) while 31.7% showed inadequate knowledge. Pharmacists achieved the highest overall knowledge, recording both the highest proportion of adequate knowledge (77.9%) and the highest scores with a mean of 16.4 ± 2.6 and a median of 17.0 (IQR: 15.0–18.0). Physicians followed with 73.7% demonstrating adequate knowledge (mean 14.8 ± 3.2 ; median 15.0), whereas nurses had the lowest performance, with nearly half demonstrating inadequate knowledge (44.1%) compared to 55.9% adequate (mean 12.1 ± 4.1 ; median 12.0). Overall, the total sample achieved a mean knowledge score of 14.2 ± 3.8 and a median score of 14.0 (IQR: 12.0–17.0)

Table 2. Knowledge scores regarding antimicrobial stewardship by professional category

Professional Category	Mean $\pm$ SD	Median (IQR)	Adequate n (%)	Inadequate n (%)
Physician (n=133)	14.8 ± 3.2	15.0 (12.0–17.0)	98 (73.7)	35 (26.3)
Nurse (n=111)	12.1 ± 4.1	12.0 (9.0–15.0)	62 (55.9)	49 (44.1)
Pharmacist (n=68)	16.4 ± 2.6	17.0 (15.0–18.0)	53 (77.9)	15 (22.1)
Total (n=312)	14.2 ± 3.8	14.0 (12.0–17.0)	213 (68.3)	99 (31.7)

3.3 Attitude Toward Antimicrobial Stewardship

Table 3 shows the attitude scores regarding antimicrobial stewardship across professional categories ($N = 312$), where overall, nearly three-quarters of the participants demonstrated a positive attitude (71.5%) while 28.5% exhibited a negative or neutral attitude. Physicians demonstrated the highest overall attitude scores, recording the largest proportion of positive attitudes (77.4%) and the highest average score (mean 3.9 ± 0.5). Pharmacists followed with 70.6% showing a positive attitude and a mean score of 3.8 ± 0.6 , while nurses reported the lowest performance, with 64.9% demonstrating a positive attitude and 35.1% showing a negative/neutral attitude (mean 3.5 ± 0.7). Overall, across all groups, the total mean attitude score was 3.7 ± 0.6 .

Table 3. Attitude scores regarding antimicrobial stewardship by professional category

Professional Category	Mean $\pm$ SD	Positive Attitude n (%)	Negative/Neutral Attitude n (%)
Physician (n=133)	3.9 ± 0.5	103 (77.4)	30 (22.6)
Nurse (n=111)	3.5 ± 0.7	72 (64.9)	39 (35.1)
Pharmacist (n=68)	3.8 ± 0.6	48 (70.6)	20 (29.4)
Total (n=312)	3.7 ± 0.6	223 (71.5)	89 (28.5)

3.4 Practice of Antimicrobial Stewardship

Table 4 shows the practice scores regarding antimicrobial stewardship across professional categories ($N = 312$), where overall, slightly more than half of the study participants demonstrated good practice (54.2%) while 45.8% showed suboptimal practice. Physicians recorded the highest proportion of good practice at 59.4% (with 40.6% suboptimal practice) and an average score of 8.4 ± 2.2 . Pharmacists achieved the highest average score (mean 9.3 ± 1.8), with 55.9% demonstrating good practice and 44.1% showing suboptimal practice. Nurses had the lowest performance, with more than half showing suboptimal practice (53.2%) compared to 46.8% with good practice (mean 7.2 ± 2.7). Overall, across all groups, the total mean practice score was 8.1 ± 2.4 .

Table 4. Practice scores regarding antimicrobial stewardship by professional category

Professional Category	Mean $\pm$ SD	Good Practice n (%)	Suboptimal Practice n (%)
Physician (n=133)	8.4 ± 2.2	79 (59.4)	54 (40.6)
Nurse (n=111)	7.2 ± 2.7	52 (46.8)	59 (53.2)
Pharmacist (n=68)	9.3 ± 1.8	38 (55.9)	30 (44.1)
Total (n=312)	8.1 ± 2.4	169 (54.2)	143 (45.8)

3.5 Association Between Knowledge, Attitude, and Practice

Table 5. Association between sociodemographic characteristics and Knowledge outcomes (N = 312)

Variable	Subcategory	Adequate Knowledge n (%)	Inadequate Knowledge n (%)	Total (n)	χ ² Statistic	p-value
Gender	Male	88 (67.7)	42 (32.3)	130	0.035	0.412
	Female	125 (68.7)	57 (31.3)	182		
Professional Designation	Physician	98 (73.7)	35 (26.3)	133	11.231	< 0.001
	Nurse	62 (55.9)	49 (44.1)	111		
	Pharmacist	53 (77.9)	15 (22.1)	68		
Years Experience of	< 1 year	16 (57.1)	12 (42.9)	28	8.817	0.032
	1–5 years	108 (63.2)	63 (36.8)	171		
	6–10 years	29 (72.5)	11 (27.5)	40		
	> 10 years	60 (82.2)	13 (17.8)	73		

Knowledge regarding antimicrobial stewardship showed statistically significant associations with professional designation ($p < 0.001$) and years of experience ($p = 0.032$). Pharmacists demonstrated the highest rate of adequate knowledge (77.9%), closely followed by physicians (73.7%), while nurses recorded the lowest proportion (55.9%). Additionally, adequate knowledge increased progressively with experience, rising from 57.1% among participants with less than 1 year of experience to 82.2% among those with more than 10 years. Gender did not show a statistically significant association with knowledge levels ($p = 0.412$).

Table 6: Association between sociodemographic characteristics and Attitude outcomes (N = 312)

Variable	Subcategory	Positive Attitude n (%)	Negative/Neutral Attitude n (%)	Total (n)	χ ² Statistic	p-value
Gender	Male	92 (70.8)	38 (29.2)	130	0.055	0.673
	Female	131 (72.0)	51 (28.0)	182		
Professional Designation	Physician	103 (77.4)	30 (22.6)	133	5.718	0.057
	Nurse	72 (64.9)	39 (35.1)	111		
	Pharmacist	48 (70.6)	20 (29.4)	68		
Years Experience of	< 1 year	18 (64.3)	10 (35.7)	28	3.22	0.189
	1–5 years	118 (69.0)	53 (31.0)	171		
	6–10 years	32 (80.0)	8 (20.0)	40		
	> 10 years	55 (75.3)	18 (24.7)	73		

Overall, positive attitudes toward antimicrobial stewardship were widespread across all demographic groups. Physicians reported the highest proportion of positive attitudes (77.4%), followed by pharmacists (70.6%) and nurses (64.9%), though this variation across professional designations only approached statistical significance ($p = 0.057$). Attitude scores did not differ significantly by gender ($p = 0.673$) or years of experience ($p = 0.189$).

Table 7: Association between sociodemographic characteristics and Practice outcomes (N = 312)

Variable	Subcategory	Good Practice n (%)	Suboptimal Practice n (%)	Total (n)	χ ² Statistic	p-value
Gender	Male	68 (52.3)	62 (47.7)	130	0.313	0.541
	Female	101 (55.5)	81 (44.5)	182		
Professional Designation	Physician	79 (59.4)	54 (40.6)	133	3.882	< 0.001
	Nurse	52 (46.8)	59 (53.2)	111		
	Pharmacist	38 (55.9)	30 (44.1)	68		
Years of Experience	< 1 year	14 (50.0)	14 (50.0)	28	1.714	0.216
	1–5 years	88 (51.5)	83 (48.5)	171		
	6–10 years	24 (60.0)	16 (40.0)	40		
	> 10 years	43 (58.9)	30 (41.1)	73		

Practice scores were significantly associated with professional designation ($p < 0.001$). Physicians reported the highest rate of good practice behaviors (59.4%), followed by pharmacists (55.9%), whereas nurses reported the lowest proportion of good practice (46.8%) and a higher rate of suboptimal practice (53.2%). Differences in practice scores across gender ($p = 0.541$) and years of experience ($p = 0.216$) were not statistically significant.

3.6 Barriers to Antimicrobial Stewardship Practice

Table 8: Distribution of barriers to optimal antimicrobial stewardship (AMS) practice among respondents with suboptimal practice

Sl. No.	Barriers to Optimal AMS Practice	Frequency (n)	Percentage (%)
1	Heavy clinical workload	96	67.1
2	Lack of accessible institutional guidelines	63	44.1
3	Insufficient training on AMS	55	38.5
4	Perceived resistance from senior colleagues	35	24.5
	Total	143	100.0

Among the 143 respondents with suboptimal practice, the most commonly cited barriers included heavy clinical workload (67.1%, $n = 96$), lack of accessible institutional guidelines (44.1%, $n = 63$), insufficient training on AMS (38.5%, $n = 55$), and perceived resistance from senior colleagues (24.5%, $n = 35$).

DISCUSSION

The findings of this study show picture of antimicrobial stewardship engagement among healthcare professionals. While knowledge and attitudes appear reasonably favorable, a discernible gap emerges when these attributes are translated into daily clinical practice — a pattern that resonates with stewardship literature from diverse geographical and institutional contexts. [9,10]

The overall adequate knowledge rate of 68.3% is broadly consistent with studies conducted in comparable settings. For instance, a multi-center survey in Saudi Arabia reported adequate knowledge among 64% of healthcare workers [11]. while a Nigerian study found a slightly lower prevalence of 58%. [12] The comparatively superior knowledge observed among pharmacists; their training curricula typically embed pharmacology and therapeutics more intensively, and they often serve as the institutional memory for antimicrobial policies. What warrants attention, however, is the pronounced knowledge deficit among nursing staff — particularly regarding de-escalation principles and antibiogram utilization. Nurses, by virtue of their continuous bedside presence, are uniquely positioned to monitor patient responses and flag opportunities for therapy modification. Their underperformance in this domain represents a missed opportunity for integrated stewardship.

Attitudes toward AMS were overwhelmingly positive, with over seven in ten respondents endorsing the value of stewardship programs. This is encouraging, as attitudinal resistance has historically impeded the uptake of restrictive prescribing policies. [13] The high level of buy-in observed here suggests that professionals recognize the existential threat posed by antimicrobial resistance and are philosophically committed to addressing it. Yet the finding that nearly four in ten respondents viewed

current institutional guidelines as impractical hints at a critical disconnect. Guidelines that are perceived as cumbersome or poorly adapted to local workflow realities risk being honored more in the breach than in the observance — regardless of how positive underlying attitudes may be.

The practice domain revealed the study's most sobering finding: fewer than 55% of respondents reported consistently good stewardship behaviors. This knowledge-practice discordance is neither novel nor unique to this institution. It has been documented across high-, middle-, and low-income countries alike and reflects the complex interplay of individual cognition, organizational culture, and systemic constraints. [14,15] In our setting, the low rates of antibiogram consultation (38.1%) and participation in restriction protocols (42.6%) are particularly concerning. These behaviors are foundational to any functional stewardship program; without them, empirical prescribing remains essentially unguided, and the feedback loops necessary for continuous improvement remain severed.

Several factors likely contribute to this implementation shortfall. The regression analysis identified knowledge and attitude as significant predictors of practice, yet these variables explained only a modest proportion of the variance — suggesting that structural and environmental factors exert considerable influence. The barriers reported by respondents lend credence to this interpretation. Heavy workload, cited by two-thirds of those with poor practice, is a perennial challenge in resource-constrained tertiary hospitals where patient-to-staff ratios often exceed recommended thresholds. When clinical decisions must be made under time pressure, the path of least resistance frequently involves defaulting to broad-spectrum empirical regimens rather than engaging in the deliberative process that stewardship ideally demands.

The relative inaccessibility of institutional guidelines — noted by 44% of respondents — is another modifiable barrier. In an era of digital health, the persistence of paper-based or poorly organized guideline repositories is anachronistic and counterproductive. Converting these resources into readily accessible, point-of-care decision support tools could substantially lower the activation energy required for guideline-concordant practice.

Interestingly, years of experience predicted knowledge in bivariate analysis but lost significance in the multivariate model. This suggests that the effect of experience may be mediated through professional role or continuous exposure to educational activities rather than through tenure alone. It also cautions against the assumption that seniority automatically confers stewardship expertise; targeted education may be necessary across all career stages.

Strengths and Limitations

This study benefits from a reasonably large, multi-professional sample and multicentric. . However, several limitations like cross-sectional design precludes causal inference, and the reliance on self-reported practice introduces the possibility of social desirability bias — respondents may have overstated their adherence to stewardship behaviors.

CONCLUSION

Healthcare professionals demonstrated moderate knowledge and largely positive attitudes toward antimicrobial stewardship, yet these did not consistently translate into corresponding practice behaviors. The identified barriers — workload, guideline accessibility, and training gaps — are amenable to intervention. Closing the knowledge-practice divide will require not only educational investments but also organizational reforms that make stewardship the path of least resistance rather than an additional burden. As antimicrobial resistance continues to escalate, the urgency of such integrated approaches cannot be overstated.

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