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Knowledge and Self-Reported Practices on Antibiotic Administration and Antibiotic Stewardship among Nursing Staff in Surgical Wards at a Tertiary Care Unit, Central Sri Lanka

M.Dulanjane¹, V.Liyanapathirana²

¹Department of Nursing, Faculty of Allied Health Sciences, University of Peradeniya, Peradeniya, Sri Lanka

²Professor in Microbiology, Department of Microbiology, Faculty of Medicine, University of Peradeniya, Peradeniya, Sri Lanka

Correspondence:

V. Liyanapathirana

E mail: veranja.liyanapathirana@med.pdn.ac.lk

 <https://orcid.org/0000-0002-4356-2172>

ABSTRACT

Background: Antimicrobial resistance (AMR) poses a significant global health threat, particularly in low- and middle-income countries. Nurses, integral to antibiotic administration, may inadvertently contribute to AMR due to knowledge and practice gaps. In surgical settings, improper antibiotic use can exacerbate resistance. Antimicrobial stewardship (AMS) programs aim to optimize antibiotic use and mitigate AMR. Objectives: To assess surgical ward nurses' knowledge, attitudes, and self-reported practices regarding antibiotic administration, and to examine associations with professional experience, training, and demographics. **Methodology:** A descriptive cross-sectional study was conducted among 130 nurses in the surgical units of the National Hospital, Kandy. A validated self-administered questionnaire evaluated knowledge, attitudes, and practices related to antibiotic administration. Data analysis included descriptive statistics, Chi-square and Fisher's exact tests for categorical variables, and Kruskal-Wallis and Mann-Whitney tests for continuous variables. **Results:** Participants were predominantly female (80.8%), aged 30–40 years (53.8%), with diplomas (55.4%), and less than five years of experience (47.7%). Knowledge levels were moderate in 64.6% and poor in 18.5%. Notably, 16.9% believed antibiotics are effective against viral infections, and 32.3% did not recognize nausea/vomiting as signs of anaphylaxis. AMS awareness was moderate (60.8%). Practice gaps included correct IV drop rate calculation (61.5%) and cannula patency checks (60.0%). The mean practice score was 50.71 (SD 5.42), with 71.5% demonstrating good practices. Higher education correlated with better knowledge ($p=0.003$); attitudes and practices showed no significant demographic associations. **Conclusions:** Identified gaps in knowledge, AMS awareness, and antibiotic administration practices among nurses highlight the need for targeted education and training to enhance practices and combat AMR.

Keywords: Antimicrobial stewardship, nursing education, antibiotic resistance, surgical wards, Sri Lanka

INTRODUCTION

Antimicrobial resistance (AMR) is a global health crisis, disproportionately affecting low- and middle-income countries (LMICs) due to inadequate stewardship programs, inconsistent

policy implementation, and high antibiotic consumption in hospitals. Nurses play a critical role in antibiotic administration and patient monitoring, yet AMS integration in nursing education remains insufficient. Despite the recent introduction of the WHO "AWaRe"



classification and AMS programs in Sri Lanka in 2024, gaps in nursing knowledge and compliance with antibiotic stewardship remain underexplored [1, 2]. Surgical units, such as those at National Hospital Kandy, Sri Lanka, have a higher antibiotic usage than other wards, highlighting the need for targeted interventions [3]. This study evaluates the knowledge, attitudes, and practices of surgical ward nurses regarding antibiotic administration, aiming to identify gaps and inform future educational strategies.

METHODOLOGY

This cross-sectional descriptive study included 130 nurses from surgical wards at the National Hospital Kandy. A self-administered, validated questionnaire assessed demographics, antibiotic knowledge, AMS awareness, attitudes, and self-reported practices. Ethical approval was obtained from the Faculty of Allied Health Sciences, University of Peradeniya, Sri Lanka (AHS/ERC/2024/096), with hospital authorization and informed consent from participants. Data were analyzed using descriptive statistics, and knowledge, attitude, and practice scores were categorized based on Bloom’s cut-off points. Associations with demographic factors were examined using Chi-square, Fisher’s Exact, Kruskal-Wallis, and Mann-Whitney tests.

RESULTS

Table 1: Participants’ responses to the knowledge assessment questionnaire (N = 130)

1. a – True/False questions	True	False
Antibiotics are used to treat bacterial infections	123 (94.6%)	7 (5.4%)
Antibiotics cure viral infections (n=128)	22 (16.9%)	106 (81.6%)
Signs of potentially severe allergic reactions (anaphylaxis) for antibiotics include;		
● Swelling of the lips, tongue, or throat	99 (76.2%)	31 (23.8%)
● Shortness of breath or wheezing	64 (49.2%)	66 (50.8%)
● Rapid or weak pulse	48 (36.9%)	82 (63.1%)
● Nausea or vomiting	42 (32.3%)	88 (67.7%)

Socio-Demographic Characteristics of the Participants

Out of 130 nurses, 25 (19.2%) were male and 105 (80.8%) were female. The largest age group was 30–40 years (70, 53.8%), followed by 20–30 years (31, 23.8%). Regarding professional qualifications, 72 (55.4%) held a diploma, 54 (41.5%) a bachelor’s degree, and 4 (3.1%) a master’s degree. Nearly half 62 (47.7%) had less than five years of experience in surgical wards, while only 16 (12.3%) had more than 15 years of experience.

Knowledge of antibiotics, antibiotic resistance, and antibiotic administration among study participants

While 123 (94.6%) correctly recognized antibiotics as effective for bacterial infections, misconceptions persisted, with 22 (16.9%) believing they could treat viral infections. Recognition of key anaphylaxis signs such as nausea or vomiting (42, 32.3%) and shortness of breath (64, 49.2%) was notably low, suggesting gaps in identifying severe allergic reactions. Nevertheless, participants displayed good procedural knowledge; nearly all would discontinue antibiotics and notify a doctor immediately during an allergic reaction, and a general understanding of antimicrobial stewardship principles, such as resistance prevention.

● Fever	26 (20%)	104 (80%)
What should be done when a patient experiences an allergic reaction to an antibiotic?		
● Discontinue the antibiotic immediately (n=129)	128 (98.5%)	1 (0.8%)
● Notify the doctor immediately (n=128)	125 (96.2%)	3 (2.3%)
● Monitor vital signs and observe the patient only (n=121)	72 (55.4%)	49 (37.7%)
The emergence and spread of antibiotic resistance happen due:		
● Overuse and misuse of antibiotics (n=128)	127 (97.7%)	1 (0.8%)
● Genetic mutations in bacteria (n=116)	104 (80.0%)	12 (9.2%)
● Inadequate dosage regimes (n=116)	103 (79.2%)	13 (10.0%)
● Poor infection control practices (n=117)	85 (65.4%)	32 (24.6%)
1.b – select type questions		
1) What is the purpose of antibiotic susceptibility testing?		
● To determine the most appropriate antibiotic therapy for a specific infection	98 (75.4%)	
● To assess the patient's immune response to antibiotics	17 (13.1%)	
● To monitor for adverse effects of antibiotic therapy	12 (9.2%)	
● Not answered	3 (2.3%)	
When administering antibiotics via the IV route, which of the following factors should be considered to prevent complications		
● Correct dilution and infusion rate	115 (88.5%)	
● Proper site selection and intravenous catheter care	103 (79.2%)	
● Monitoring for signs of phlebitis or infiltration	104 (80.0%)	
2) Which of the following ways is the correct way to write an antibiotic prescription?		
● Three times a day	12 (9.2%)	
● 8 hourly	117 (90.0%)	
● Not answered	1 (0.8%)	

* 1a – Numbers in brackets indicate respondents when fewer than 130. Percentages are based on all participants (N = 130)

The mean knowledge score was 23.88 (SD 3.82), with a median of 24.0 (IQR 21.75–26.0) out of a maximum obtainable score of 34. Based on Bloom's cut-off points, knowledge was categorized as poor (<60%), moderate (60–80%), and good (>80%): 84 (64.6%) had moderate knowledge: 22 (16.9%) had good knowledge and 24 (18.5%) had poor knowledge. A statistically significant association was observed between education level and knowledge levels ($p=0.003$, Chi-square test), where 14 (42.1%) of those with a degree had good knowledge compared to 8 (11.1%) of those with a diploma having good knowledge. No significant relationship was found with age (Independent-Samples Kruskal-Wallis Test), gender (Chi-square test), or work experience. (Independent-Samples Kruskal-Wallis Test) and knowledge levels.

Awareness of antibiotic stewardship among study participants

AMS awareness was moderate, with only 79 (60.8%) of nurses reporting familiarity with AMS concepts. Of these 79; 70 (88.61%) correctly disagreed to the statement "antibiotic stewardship aims to promote the indiscriminate (uncontrolled) use of antibiotics"; 72 (91.14%) agreed to the statement "antibiotic stewardship involves optimizing antibiotic use to improve patient outcomes and reduce the emergence of antibiotic resistance" and 35 (44.30%) incorrectly agreed to the statement "antibiotic stewardship is

primarily focused on increasing antibiotic prescriptions". Seventy-three (92.4%) and each agreed to the statements "nurses can contribute to antibiotic stewardship by teaching patients how to use antibiotics properly" and "nurses can contribute to antibiotic stewardship by keeping track of antibiotic use in the ward".

Among them the 79: 26 (32.9%) demonstrated good AMS awareness (>80%), 32 (40.5%) had moderate awareness (60–80%), and 21 (26.6%) had poor awareness (<60%). AMS awareness was not significantly associated with experience, education (Chi-square test), or age (Independent-Samples Kruskal-Wallis Test), highlighting the need for structured AMS education within nursing curricula.

Attitude on antibiotics and antibiotic administration among study participants

Although a high proportion of participants expressed confidence in identifying antibiotic indications for antibiotics (125, 96.2%), dosages (121, 93.1%), and side effects (124/129, 95.4%), this confidence does not seem to fully translate into stewardship-related action. While 113 (86.9%) participants indicated they were knowledgeable about antibiotic resistance and about 90% demonstrated readiness to question prolonged antibiotic use, raising concerns about other inappropriate uses was less likely (Table 2).

Table 2: Participants' responses to the attitude assessment questionnaire (N = 130)

Question	Strongly agree/agree	Neutral	Disagree/strongly disagree
1) I can identify the common indications for antibiotic use	125 (96.2%)	2 (1.5%)	3 (2.3%)
2) I am familiar with the recommended dosage and frequency of commonly prescribed antibiotics	121 (93.1%)	6 (4.6%)	3 (2.3%)
3) I can recognize the potential side effects associated with antibiotics (n=129)	124 (95.4%)	4 (3.1%)	2 (1.6%)
4) I am knowledgeable about antibiotic resistance	113 (86.9%)	12 (9.2%)	5 (3.8%)
5) We should advise patients to complete the	115 (88.4%)	4 (3.1%)	10 (7.7%)

prescribed antibiotic course even if they feel better (n=129)			
6) Nurses had a key role in patient and family teaching about antibiotic resistance	127 (97.7%)	2 (1.5%)	1 (0.8%)
	Very Likely	Likely	Less Likely
7) How likely are you to inform/discuss with the doctor any of the following;			
• An antibiotic is continued for more than 7 days in a patient with a chronic wound	47 (36.2%)	69 (53.1%)	14 (10.8%)
• Antibiotics started in the theater for a non-mesh hernia repair is continued in the ward	34 (26.2%)	73 (56.2%)	23 (17.7%)
• If antibiotics are continued in a patient with a chronic wound whose culture report came as "colonizers"	62 (47.7%)	54 (41.5%)	14 (10.8%)
• If more than four antibiotics are being given to a patient	40 (30.8%)	35 (26.9%)	55 (42.3%)
• Antibiotics are added to a patient without omitting any existing prescribed antibiotic (n=129)	45 (34.6%)	53 (40.8%)	31 (23.8%)

The mean attitude score was 36.25 (SD 3.87), median 36.0 (IQR 34.0–39.0) out of a maximum obtainable score of 45. The majority (69, 53.1%) had a moderate attitude (60–80%), with 60 (46.2%) demonstrating a positive attitude (>80%).

Self-reported practices on antibiotic administration among study participants.

A few significant lapses were noted in critical antibiotic administration steps. Only 80 (61.5%) calculated the IV drop rate correctly, a fundamental skill in ensuring appropriate antibiotic dosing and preventing toxicity. Only 78 (60.0%) always checked cannula patency before

administering antibiotics, which is essential to prevent extravasation and under-dosing, and only 47 (36.2%) were always likely to inform the prescribers about prolonged antibiotic use in chronic wounds (Table 3).

The maximum obtainable practice score (P-score) was 60, with scores ranging from 34 to 60. The mean P-score was 50.71 (SD 5.42), while the median was 51.0 (IQR 47.75–55.0). This score was converted to a percentage and categorized. The majority, 93 (71.5%), had good practice (>80%), while 35 (26.9%) had fair practice (60–80%) and 2 (1.5%) had poor practice (<60%).

Table 3: Participants' responses to the practice assessment questionnaire (N = 130)

Question	Always/Often	Sometime	Rarely/Never
1) I refer to the BNF if I am not very sure about a prescription given in the BHT	57 (43.8%)	50 (38.5%)	23 (17.7%)
2) I participate in continuing education or training related to antibiotic administration	61 (47.0%)	44 (33.8%)	25 (19.3%)
3) I ask the patient about a past history of food and drug allergies before giving antibiotic doses.	124 (95.4%)	6 (4.6%)	
4) I put "IV" in a red pen on the drugs chart	120 (92.3%)	8 (6.2%)	2 (1.6%)
5) I check the product leaflet of antibiotics and or the label before reconstituting IV antibiotics (n=128)	83 (63.8%)	40 (30.8%)	5 (3.9%)
6) I check the product leaflet of antibiotics and or the label to identify the storage conditions for multi-dose antibiotic vials (n=128)	85 (65.4%)	41 (31.5%)	4 (3.0%)
7) I ask the patients on antibiotics if they have diarrhea (n=126)	87 (67.0%)	30 (23.1%)	13 (10.0%)
8) I follow aseptic techniques when administering intravenous antibiotics	125 (96.1%)	4 (3.1%)	1 (0.8%)
9) I double-check and confirm the mode of administration (e.g., bolus, slow IV, etc.) before giving antibiotics to a patient	125 (96.2%)	5 (3.8%)	0
10) I check cannula patency before administering antibiotics by flushing with 1ml normal saline.	106 (81.5%)	20 (15.4%)	4 (3.1%)
11) I change the cannula within 3 days when administering an IV antibiotic (n=129)	117 (90.0%)	10 (7.7%)	3 (2.3%)
12) I calculate the drop rate when administering antibiotics via a burette set	109 (83.8%)	17 (13.1%)	4 (3.1%)

DISCUSSION

Improper antibiotic use can have severe consequences, leading to treatment failure, prolonged hospital stays, increased healthcare costs, and the acceleration of antimicrobial resistance [4]. Ensuring that nurses possess adequate knowledge and competency in antibiotic administration is critical for maintaining patient safety and quality of care in surgical wards.

Knowledge of Antibiotic Administration.

The findings indicate that while most nurses (94.6%) recognized that antibiotics are used to treat bacterial infections, misconceptions persist, with 16.9% believing antibiotics can be used for viral infections. These results align with previous studies conducted among nursing students and professionals, which report similar misconceptions [5, 6]. Additionally, only 32.3% correctly identified nausea or vomiting as potential signs of a severe allergic reaction, suggesting an urgent need for enhanced training on adverse drug reactions [7, 8].

As stated in the results section, significant association was observed between the level of nursing education and knowledge scores where those with a bachelor's degree had a higher knowledge than those with the diploma, but there was no association with age or years of experience. This finding highlights the importance of integrating antimicrobial stewardship principles into nursing curricula and continuous professional development programs [9, 10].

Awareness of Antimicrobial Stewardship

The low AMS awareness (79, 60.8%) is concerning, particularly given the recent national AMS initiatives in Sri Lanka. Among those aware of AMS, only 26 (32.9%) had a strong understanding of its principles. The lack of correlation between AMS awareness and demographic factors suggests that AMS education remains poorly integrated into routine nursing training and hospital protocols. To address this, hospital-wide AMS education programs and interactive workshops, should be implemented to strengthen AMS engagement among nurses.

Attitudes Towards Antibiotic Use

Despite 125 (96.2%) of nurses expressing confidence in identifying antibiotic indications, only 47 (36.2%) were likely to notify a doctor if a patient with a chronic wound had been on antibiotics for more than seven days. This disconnects between confidence and actual AMS engagement mirrors findings in India and Saudi Arabia, where nurses' perceived competence did not translate into proactive stewardship behaviors [11, 12]. Further, the majority (69, 53.1%) had a moderate attitude towards antibiotics, their administration and stewardship. Which indicates that an attitudinal change with emphasis of the importance of proper antibiotic administration and stewardship is essential.

One possible barrier is the hierarchical nature of healthcare systems in Sri Lanka, where nurses may hesitate to question antibiotic prescriptions. Addressing this issue requires institutional support, AMS training, and structured communication frameworks that encourage nurses to participate in stewardship discussions.

Practices in Antibiotic Administration

Although 71.5% of nurses had good self-reported antibiotic administration practices, specific gaps remain. Only 61.5% calculated the drop rate when administering antibiotics via a burette set, and 60.0% checked cannula patency before administration. These findings highlight inconsistencies in adherence to best practices, which could compromise patient safety. Studies from other regional countries such as India have also identified similar discrepancies where despite a good overall practice, certain individual practices remain poor [13]. These inconsistencies highlight the urgent need for standardized AMS training, periodic competency assessments, and reinforcement of best practices through clinical audits and supervision.

Limitations

This study was conducted in a single center and has a limited sample size, which are limitations of the study. However, we believe that the findings are important identifying the gaps that need

strengthening nursing practices in AMS, not only in Sri Lanka but in other countries with similar backgrounds. Future studies should explore qualitative perspectives on barriers to AMS engagement, particularly in the conventionally hierarchical health care systems in LMICs.

Recommendations

Antibiotic administration is a key area where nurses contribute to AMS. These findings highlight the necessity of incorporating AMS education into both undergraduate and continuing professional development programs for nurses. Given the key role of nurses in antibiotic administration, we recommend the following: Mandatory, broad and specific AMS Training including antibiotic administration in Nursing Curricula: AMS modules should be integrated into nursing education. Continuous Professional Development (CPD) for Nurses: Implement hospital-based AMS refresher courses. AMS Communication Protocols: Develop nurse-doctor AMS communication guidelines to improve working relationships of different health care providers.

CONCLUSION

This study identifies key gaps in antibiotic knowledge, AMS awareness and practices related to antibiotic administration among surgical ward nurses, emphasizing the need for systematic AMS training for nurses with particular emphasis on antibiotic administration. Given Sri Lanka's high antibiotic consumption, targeted policy-driven educational interventions are crucial to reduce AMR and improve patient safety.

Author declaration

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Authors' contribution

MD: study plan, design, proposal writing, data acquisition, data analysis, drafting and approving the paper; VL: study concept, study design, correction of proposal, advise and editing of data analysis, editing of the paper and final approval.

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Authors declare no conflict of interest.

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Ethical approval was obtained from the Faculty of Allied Health Sciences, University of Peradeniya, Sri Lanka (AHS/ERC/2024/096), administrative clearance was obtained from the Director, National Hospital, Kandy and informed written consent was obtained from the participants.

Statement on data availability:

Data are available with the corresponding author on request.

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