



NARRATIVE REVIEW

Redefining the Nurses' Role in Antimicrobial Stewardship Practices

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ABSTRACT

Antimicrobial stewardship program aims to optimize the use of antimicrobials. Through the present narrative review, we sought to identify the nurse's role in antimicrobial stewardship (AMS) practices at various healthcare facilities around the globe. Infection control, microbiology culture, intravenous (IV) to oral switch, antimicrobial de-escalation, documentation of allergy, questioning the prescription, and education were the few roles of nurses in AMS practices that emerged from documented literature published in the last ten years. The present review also showcased the best available guidelines on the prompt switch from IV to oral antibiotics, nurses' AMS checklist based on the model, and key factors to enhance the involvement of nurses in AMS practices.

KEYWORDS: Antimicrobial stewardship; de-escalation; nurse-driven antibiotic stewardship; nursing practices

INTRODUCTION

The emergence and worldwide spread of antimicrobial resistance (AMR) present a global health crisis that the US Centers for Disease Control and Prevention (CDC) and the World Health Organization (WHO) have labelled a grave threat to human health.¹ Antimicrobial-resistant bacteria can cause bacterial infections that prolong a patient's length of stay in hospital, increase patient morbidity and mortality, and increase healthcare costs. Antimicrobial stewardship programs (AMSP) aim to optimize the use of antimicrobials, including antibiotics, antivirals, antifungals and anti-parasitic drugs that treat infections caused by microbes such as bacteria, viruses, fungi and parasites respectively. In hospitals, nurses play an

essential but underappreciated role in antimicrobial stewardship (AMS).

In 2001, the WHO published a global strategy for the containment of AMR, which outlined interventions for hospitals. These included infection control initiatives to prevent the spread of AMR, guidelines for monitoring antimicrobial use, obtaining microbiology data and antimicrobial susceptibility testing.² In July 2016, the CDC and the American Nurses Association (ANA) cosponsored a full-day conference in Silver Spring, Maryland, and Nurse-driven antibiotic stewardship activities recommended by the ANA/CDC working group. Specifically, nurses may play a significant role in optimizing antibiotic treatment by 1) questioning the medical necessity of urine cultures, 2) ensuring proper

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urine and blood culturing techniques, 3) initiating the switch from intravenous (IV) to oral (PO) antibiotics; 4) obtaining and recording an accurate penicillin drug allergy history, and 5) initiating an antibiotic timeout.³

This narrative review aimed to explore the nurse's role in AMS.

NURSES AND AMSP

Historically, AMSPs have been driven primarily by physicians and pharmacists, but nurses' integral role is increasingly being recognized. This article explores the actual involvement of nurses in AMSPs and the significant impact of this involvement on improving antimicrobial stewardship related practices in health care settings.

The tangible functions performed by nurses in AMSP are summarised in Table 1.

Enhancing infection control: Nursing practices routinely focus on preventing infection, reducing the

spread of antimicrobial-resistant bacteria, and the necessity of isolation protocols and antibacterial agents. These are some of the top interventions for individuals with compromised immunity or those who may be a source of active infections.

Also, the use of an aseptic technique while performing procedures such as the insertion of an intravenous cannula and intravenously antimicrobial administration and getting a microbiology culture done before initiating the antimicrobials are the few nursing interventions under infection control practices that substantially minimize the use of antimicrobials. A few more interventions reported in different literature are changing antimicrobial administration from the intravenous to the oral route, thereby reducing the risk of healthcare-associated infection, reducing patients' length of stay, improving patient comfort, lowering healthcare costs, and decreasing nurses' workloads.^{1,2}

Table 1: Specific tasks and responsibilities of nurses in antimicrobial stewardship program (AMSP)

Sr. No	Stewardship activity or task	CDC Core stewardship element	Task or roles in current AMSP Models	Specific role of nurses in AMS
1.	Appropriate triage and isolation	Accountability of Drug and Expertise in Education	Infection Control Team	Initially, the nurse determines the appropriate measures and evaluates the cause of the infection. The infection preventionist may thereafter provide consultation.
2.	Accurate antibiotic allergy history	Accountability of Drug and Expertise in Education	Pharmacist	In addition to taking the patient's allergy history, the nurse reconciles their medications and documents them in the patient's medical file.
3.	Early and appropriate cultures	Accountability of Drug and Tracking Drug Action	Microbiologist	Before administering antibiotics, the nurse obtains the cultures and sends them to the microbiology laboratory. The nurse keeps track of the culture results and sends the information to the physician.
4.	Timely antibiotic initiation	Tracking Drug Action	Infectious Disease Specialist or Preventionist.	After getting the instructions, the nurse checks the dose and timing for correctness, looks for allergies, gives the antibiotics, and records them.
5.	Progress reporting	Tracking Drug Action	Infectious Disease Specialist	The nurse provides round-the-clock care, keeps track of daily development, and communicates it to the clinicians.
6.	Antibiotic adjustment based on	Tracking Drug Action	Infectious Disease Specialist, Microbiologist	The bedside nurse usually receives laboratory and radiological reports first as they "chase" the patient.

	microbiology reports			The nurse coordinates the results and notifies the treating physicians.
7.	Antibiotic dosing, culture and sensitivity reporting, and de-escalation	Tracking Drug Action	Infectious Disease Specialist, Microbiologist, Pharmacist	The nurse provides updates on drug levels, microbiological results (preliminary and final), and clinical and laboratory renal function outcomes.
8.	Adverse events	To reduce the risk of complication	Hospitalist, Pharmacist	The nurse observes any adverse outcomes, such as diarrhoea, and reports them to the clinician and chemist.
9.	Antibiotic orders	Tracking Drug Action	Hospitalist, Infectious Disease Specialist	The nurse reviews the patient's clinical status and changes in medications.
10.	Antibiotic resistance	Tracking Drug Action and Education	Infectious Disease Specialist, Hospitalist, Microbiologist	The nurse records medication mismatches, timeouts, and antibiotic de-escalation while reviewing culture and sensitivity results.
11.	Superinfection / resistant infection	Tracking Drug Action and Patient Education	Infectious Disease Specialist, Infection Preventionist, Microbiologist	The nurse monitors the patient's reaction and makes the necessary adjustments to isolation protocols.
12.	Transition IV-to-PO antibiotic, outpatient antibiotic therapy	Reduce the source of infection	Infectious Disease Specialist	The nurse checks patients' ability to take oral drugs and their clinical progress.
13.	Patient education, medication reconciliation	Increase medication adherence	Nurse Educator	The nurse continuously educates the patient and family and performs discharge teaching.

The most prominent examples of nurse participation in AMS-related functions have been in infection control and prevention, particularly in implementing catheter-associated urinary tract infection (CAUTI) and central line-associated bloodstream infection (CLABSI) bundle measures. A nurse-directed urinary catheter removal protocol in one centre reduced catheter use by 50% and CAUTIs by 70%.⁴ In another study, nurse reminders to physicians in intensive care units for urinary catheter removal reduced CAUTI rates and antibiotic costs. Implementing and compliance with CLABSI reduction bundles, typically operationalized by nursing staff, have reduced CLABSI rates. In a review of 14 randomized controlled trials of interprofessional collaboration among nurses and physicians, all but one reported at least one statistically significant improvement in patient outcomes following

interventions based on interdisciplinary collaboration.⁵ Once nurses are educated about and integrated into AMSPs and empowered to participate fully in antimicrobial stewardship, research focused on their then-recognized role could be performed to evaluate their impact on enhancing the performance of AMSP.⁶

Controlling the source of infection & monitoring microbiology culture: Nurses play a crucial role in managing microbiology samples; most of the time, nurses draw blood for culture. There are recommendations documented in various studies regarding the prerequisites of culture appropriately.⁷⁻⁹

Appropriate cultures using the proper technique should be obtained before antibiotics are started. It is imperative to understand how the microbiology laboratory processes those samples. Microbiology

results help guide the optimal selection of antibiotics and guide decisions to stop therapy in cases where culture results represent colonization rather than infection.

Therefore, nurses may help inform decisions to start antibiotics promptly when early signs of likely bacterial infections, including sepsis, are identified. They may also help to ensure that practices for good antibiotic use are embedded in other quality improvement efforts. For example, they ensure that antibiotics are started promptly and reviewed once additional data, especially cultures, are available for sepsis.

Prompt switch from IV to oral antibiotics:

Antimicrobial stewardship aims to optimize drug use to prolong therapeutic effectiveness and combat AMR. One key aspect of AMS is the route of administration. It is common for critically ill patients to be given empirical IV antibiotic therapy upon admission due to rapid delivery, high bioavailability, and uncertainty surrounding a potential infection.¹⁰ Then, later in the treatment regime, once the patient is stabilized, their antibiotics are often switched to the PO administration route. There is a well-described focus on switching from IV to PO administration as early as possible and using more oral drugs when appropriate (Table 2).^{9,11,12} The oral drugs are often equally effective and can reduce side effects during prolonged exposure. Beyond the infection complications of IV catheters, PO administration is more comfortable for the patient, reduces nurses' workload, and allows for easy discharge from the hospital. Additionally, PO treatment is more affordable and economical.¹¹

Table 2: Antimicrobial intravenous-to-oral switch (IVOS) criteria for timely switch categorized.

S.No	Domain	Antimicrobial IVOS Criteria
1.	Timing of IV antimicrobial review	IVOS should be considered within 48 hours of the first dose of IV antimicrobial being administered
		If no IVOS within the first 48 hours, review daily after that
2.	Clinical signs and symptoms	Clinical signs and symptoms of infection are improving
3.	Infection markers	Temperature is between 36–38 °C for the past 24 hours
		Early Warning Score is decreasing
		White cell count is trending towards the normal range *

		C-reactive protein is decreasing *
4.	Enteral route	The gastrointestinal tract is functioning with no evidence of malabsorption
		Safe swallow or enteral tube administration
		Suitable oral switch option available, considering oral bioavailability, any clinically significant drug interactions or patient allergies
		No significant concerns over patient adherence to oral treatment
		No vomiting within the last 24 hours
5.	Special considerations	Does your patient have an infection that may require special consideration?
		Infections that may require special consideration include: <ul style="list-style-type: none"> • Deep-seated infection • Infection requiring high tissue concentration • Infection requiring prolonged IV therapy • Critical infection with a high risk of mortality Specific infections for special consideration are: <ul style="list-style-type: none"> - Bloodstream infection - Empyema - Endocarditis - Meningitis - Osteomyelitis - Severe or necrotizing soft tissue infections - Septic arthritis - Undrained abscess

Initiating an antibiotic timeout or antimicrobial de-escalation (ADE): ADE is defined as the discontinuation of one or more antimicrobials in empirical therapy or the replacement of a broad-spectrum antimicrobial with a narrower-spectrum antimicrobial. Antibiotic timeouts have been shown to decrease empiric antibiotic

therapy,³ and recommendation from the literature proposes that nurses initiate a conversation with a physician 48 hours after an antibiotic had been initiated to reassess the plan of care, including the duration of anticipated antibiotic therapy and whether antibiotics could be de-escalated from a broad-spectrum to a narrow-spectrum antibiotic.^{2,8,13}

Document/discuss allergies: Early identification and documentation of a medication allergy history are prerequisites for staff nurses in the expanded role of nurses towards AMS. Hence, nurses must be taught the difference between a true allergy and adverse events that would not preclude using certain antibiotics.⁶ During history collection, the nurse must ask for and document the patient's history of medication usage, and any allergy-related history could become a valuable component of medication allergy reconciliation. A label of penicillin "allergy" has been documented to be associated with increased antibiotic costs, improved selection of antibiotic-resistant microbes, and increased length of stay and hospital costs.¹³

Question the prescriber: The healthcare provider who receives the order for antibiotics submits the order to the pharmacy, administers the medication, records its dose and timing, and monitors the effects of treatment and adverse events.⁵ However, there are incidences of inconsistent prescription patterns and frequency of antibiotics by healthcare providers who need help understanding the doctor's prescription. Therefore, nurses should question the prescription of antibiotics if they feel it does not comply with the antibiotic policy of the institute.¹⁶

Patient education and advocacy: Education about AMS is essential not only for physicians but for every healthcare discipline, as well as for public health policymakers, legislators, and the general public. Nurses should be included in this educational effort as the largest single group of healthcare providers.⁵ However, nurses should receive special attention to AMS education since they might not consider themselves to be prescribers of antibiotics and might not consider their work as facilitating AMS.¹⁴ It is common for nurses to be taught microbiology and sometimes even antibiotic pharmacology as a pure rather than an applied science. As such, the relevance and application of AMS to clinical nursing activities and their interdisciplinary relatedness is not immediately apparent. Nurses can be trained about appropriate antibiotic prescribing, as nurses and nurse practitioners acknowledge their need for further education regarding the proper use of antibiotics.⁷ This educational deficit

should be addressed by in-service educational programs, national and international AMS authorities like the Indian Council of Medical Research (ICMR), CDC, and WHO, academic institutions such as nursing colleges and teaching hospitals, and professional societies working towards AMS practices like the Society of Antimicrobial Practices (SASPI) in India.

Therefore, the role of nurses becomes imperative in implementing AMSP in any patient care setting. A comprehensive checklist of stewardship activities for nurses based on the AMS model has been mentioned in Table 3.

Table 3: A comprehensive checklist of antimicrobial stewardship (AMS) activities for nurses

S.No.	Stewardship activities
1	Patient admission
	Triage and appropriate isolation
	Accurate allergy history
	Early and appropriate culture
	Timely antimicrobial initiation
	Medication recognition
2	Daily clinical progress monitoring
	Monitor patient progress report
	Preliminary culture results and antimicrobial adjustment
	Antimicrobial dosing and de-escalation
3	Patient safety and quality monitoring
	Adverse events
	Change in patient condition
	Final culture report and antimicrobial adjustment
	Antimicrobial resistance identification
	Monitor outcome
4	Clinical progress, patient education and discharge
	IV to PO switch
	Outpatient antimicrobial therapy (OPAT)
	Patient Education
	Length of stay
	Early discharge
5	Community Education
	Public Education

Key factors to enhance the involvement of nurses in

AMSP: Several factors drive the involvement of nurses in AMPSP.^{2,3,11,13,16}

1. Microbiology education and training on obtaining cultures and interpreting the reports.
2. Education about infection versus colonization.
3. Assertiveness training to engage in discussions with the health care team.
4. Information on IV-PO switch criteria
5. Training on taking an allergy history
6. Providing AMS education for bedside nurses. This could be provided by nurses already engaged in stewardship activities, infectious disease physicians, pharmacists, infection preventionists, or microbiologists.
7. Inclusion of nurses in stewardship rounds
8. Developing specific content and messages for nurses as part of any hospital effort to raise awareness about antibiotic use and resistance
9. Encouraging nurse AMS champions at the unit level

CONCLUSION

Nurses are integral participants in AMS and can play a pivotal role in effectively implementing AMS practices. However, if nurses are not formally integrated into the structure of AMSPs, they cannot meaningfully contribute to the processes of AMS activities and, therefore, cannot have as critical an impact on time-to-intervention, efficiency, broad acceptance of AMS, and outcomes. The present review summarizes the role of the nurse in the early and appropriate collection of specimens for culture as the first link of a chain leading to a microbiological diagnosis and antimicrobial susceptibility determination, antimicrobial adjustment, and de-escalation, IVOS, OPAT, the importance of documentation of allergy, questioning the prescribers and education which will substantially reduce the patient length of stay and minimize the use of antimicrobials. Every hospital should design and implement and improve their own checklists as above for their own nurses' role and responsibilities to target CDC core elements of the AMSP model.

CONFLICTS OF INTEREST STATEMENT

The authors declare no conflict of interest.

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AUTHOR'S CONTRIBUTION

MS: Conceptualization; Literature Search; Review; Approve

VP: Literature Search; Writing the draft; Approve

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