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A Novel Framework to Guide Antibiotic Stewardship Nursing Practice

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Abstract

Nurses have always been involved in the antibiotic stewardship process, but there remains a pervasive view among some nurses and health care disciplines that antibiotic stewardship is solely a physician or pharmacist responsibility. There is a pressing need to alter this view so that nurses can seize every opportunity to prevent patient harm from antibiotics and to optimize their use. The purpose of this article is to offer a comprehensive, globally applicable organizing framework to guide local-level nurses to lead antibiotic stewardship nursing practice. Our ultimate goal is to serve as a catalyst to elevate nurses’ profile as trusted and valuable partners in slowing the emergence of antibiotic resistance.
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Introduction
Antibiotic resistance (ABR) is one of the most vexing problems facing humanity. It is a silent pandemic poised to reverse a century of medical progress, rendering antibiotics ineffective in treating even the most common infectious diseases.\(^1\)-\(^3\) Without global action, it is predicted that deaths attributed to antibiotic resistant bacterial infections will climb from the current 700,000 per year to over 10 million deaths per year by 2050 with a total gross domestic product loss of $100 trillion.\(^4\) The World Health Organization (WHO) rates ABR as a ‘global security threat’ impacting global health, food security and development and as important as terrorism and climate change.\(^5\) The human costs of ABR infections are significant. In addition to death and disability, prolonged illness results in longer hospital stays, treatment failures and toxicities. Any use of antibiotics, however appropriate, contributes to the development of ABR, but widespread misuse is a primary driver.\(^4\) Misuse refers to use without need, use without prescription, self-medication, and irregular or interrupted dosing or sharing of antibiotics.\(^6\)-\(^7\) The COVID-19 pandemic is
likely exacerbating the ABR problem. A meta-analysis and systematic review focusing on bacterial co-infections in patients hospitalized for COVID-19 found that despite an overall low rate (6.9% (95% CI 4.3–9.5%) of bacterial infections, over 70% of patients received antibiotics, with the majority constituting broad-spectrum agents such as fluoroquinolone and third-generation cephalosporins. Antibiotic stewardship (AS) programs have been shown to reduce antibiotic misuse, improve patient outcomes and minimize adverse events associated with antibiotic use, including *Clostridioides difficile* infections.

**Antibiotic Stewardship**

According to the Infectious Diseases Society of America, the Society for Healthcare Epidemiology of America, and the Pediatric Infectious Diseases Society AS represents ‘coordinated interventions designed to improve and measure the appropriate use of [antibiotic] agents by promoting the selection of the optimal [antibiotic] drug regimen including dosing, duration of therapy, and route of administration.’ This frequently cited 2012 definition focuses on formal AS programs that are staffed by infectious disease physicians and pharmacists tasked with leading interventions to improve clinician antibiotic prescribing practices through top-down actions of formulary restriction and prospective audit with feedback. Some argue, and we agree, that the definition and approach is too circumscribed, limiting the scope, reach and impact of all persons and professions who seek to preserve and promote the intrinsic value of antibiotics. Another way forward is to consider AS within the tenets of patient safety, and promote local-level ‘stewarding’ behaviors that tap into the interprofessional team’s collective knowledge, expertise, relationships and wisdom. Implicit in our AS framing is acknowledgement of the importance of team collaboration, however, our primary focus is the central role of nursing
in daily patient care and patient advocacy. Thereupon, we draw from the nursing, quality, antibiotic, environmental, and social sciences stewardship literature, and define AS as: *Local actions taken by the entire healthcare team to protect, care for and responsibly use antibiotics to prevent patient harm and optimize use in diverse clinical, social-structural and behavioral contexts.*\(^{11-16}\)

We posit that the nursing profession define its own scope of AS practice, that nursing AS practices be intentionally selected (and strategically align with the organization’s AS program) and led by self-empowered nurses giving ample consideration to the local context and culture and tailored to the needs and resources of a particular patient population, clinical setting or clinical specialty. The purpose of this article is to present a globally applicable organizing framework to help guide local-level nurses to lead and participate in AS nursing practice. We begin with a brief review of the current state of nurse engagement in AS, then turn to our proposed framework.

**Current State of Antibiotic Stewardship and Nursing**

Position statements and opinion pieces consistently affirm that nursing perspectives and nurses’ active participation are crucial to keeping patients safe from antibiotic harm, optimizing the use of currently available antibiotics and slowing the emergence of ABR bacteria - the goals of AS.\(^{11,17-18}\) Numerous quantitative and qualitative studies indicate that nurses are often unfamiliar with the term antibiotic stewardship, and the clinical practices that nurses already perform that impact antibiotic decisions (i.e., obtaining appropriate specimens for cultures prior to antibiotic initiation and assessing for antibiotic adverse events). However, once explained and reframed, nurses can identify their AS practice-related responsibilities, pinpoint their knowledge gaps and identify their educational needs to fill the gaps.\(^{19-20}\) A recent integrative review on nurse’s role
and contribution to AS found that in many contexts nurses remain disconnected from AS activities.21 This is not surprising as most studies related to nurses’ engagement in AS provide little evidence of educating nurses on what it means to be a steward of an intrinsically valuable resource (i.e. antibiotics) for patients, organizations or populations. Furthermore, research-related AS interventions provide little if any strategic or local context, have omitted nurses from the intervention/s selection decision making process, or considered how the intervention/s align with nursing’s workflow or communication patterns or future-oriented priorities. Without such context, some nurses may continue to view AS as a list of unlinked, unrelated clinical tasks without strategic clarity and potentiates the misperception that it is solely the domain of pharmacists and physicians. Our evidence-based Antibiotic Stewardship Nursing Practice SCAN-P Framework provides the much-needed context and clarity to guide nurse engagement in AS. The framework went through multiple iterations as it was vetted with nurse clinicians, physicians, pharmacists and educators.22

**Framework for Antibiotic Stewardship Nursing Practice**

The Antibiotic Stewardship Nursing Practice SCAN-P Framework is depicted in Figure 1. The core or center of the framework affirms the overarching AS goals to prevent patient harm and optimize appropriate antibiotic use, i.e., promoting the use of the right agent at the correct dosage and for the proper duration. The framework scaffolding is built on the fundamental nursing intervention of clinical surveillance - a primary strategy used by bedside nurses to promote patient safety and prevent avoidable harm.23-24 Similar in principle to infection surveillance used by infection preventionists, clinical surveillance relies on nurses’ ability to gather, interpret, and synthesize real-time data to drive clinical decision making in order to promote and maintain patient safety.25 Nurses report using surveillance, or the act of “systematically assessing patients by
scanning the patient and the patient’s immediate environment” as a safety strategy to identify and prevent medical errors. For these reasons, we organized our framework using the acronym “SCAN” to illuminate how nurses continuously and systematically use clinical surveillance to scan the patient’s clinical condition and environment to promote and maintain their safety - in this case their safety related to antibiotic use. The deconstructed framework elements “S” and “C” consider the crucial factors that influence and support nursing success and “ANP” identifies selected evidence-based AS nursing practices. An explanation of each element follows.

**S - Scope & Standards of Nursing Practice**

Preventing patient harm and optimizing antibiotic use are patient safety issues and clearly within nursing’s scope of practice, as an extension of their roles as patient advocates. The International Council of Nurses (ICN), a federation of more than 130 national nurses associations representing more than 27 million nurses worldwide, released an Antimicrobial Resistance Position Statement in 2004. Revised in 2017, the statement declares that nurses ‘have a vital role to play in preserving the power of antimicrobial medicines’ and are in a ‘key position to contribute to reducing antimicrobial resistance and critical for the function of antimicrobial stewardship programs.’

In the United States, nursing practice is guided by the American Nurses Association (ANA) *Scope and Standards of Practice* (2015) and the ANA *Code of Ethics for Nurses with Interpretive Statements* (2015). Building on these standards the ANA, in partnership with The US Centers for Disease Control and Prevention (CDC), released a white paper in 2017 supporting hospital nurses engagement in AS and identified numerous areas where nurses could have an impact on patient outcomes. Efforts to engage nurses in AS should begin by discussing the ICN statement and country specific nursing standards of practice that promote nursing’s stewardship role - defined as
a person who preserves and promotes the intrinsic value of a situation and engages others in solutions and actions. Only then can AS be placed within the larger context of preserving and promoting the intrinsic value of antibiotics. Such discussions could also help uncover local-level nurses’ readiness to engage in AS practice changes.

C - Context, Culture & Competency

The extent to which nurses can successfully select, implement and evaluate local-level nursing AS practices is highly dependent on the inter-related dynamics of organizational context and culture, and nurses’ competency in AS knowledge, skills and abilities.

Context (Organizational)

Context influences the implementation of healthcare quality and patient safety interventions, thus it is important to understand the environment in which an evidence-based intervention (i.e. nursing AS practice) is embedded. According to Rogers and colleagues context is defined as “a multi-dimensional construct encompassing micro, meso and macro level determinants that are pre-existing, dynamic and emergent throughout the implementation process.” Contextual determinants include leadership, social relationships, individual perceptions of the implementation effort, organizational characteristics, organizational support, and the availability of financial and human resources. These dynamic features alone or in combination act as facilitators and barriers to successful implementation. Studies show that having leadership support at the organization and unit levels and an infrastructure to support change initiatives constitute favorable conditions for nursing AS implementation, while leadership that is lacking in authority and support presents a barrier for success. Nurses planning AS initiatives must carefully consider how context will support successful practice implementation. For example, a recent study illustrates how nurses in a surgical intensive care unit used their existing shared governance structure, their
embedded presence in daily patient rounds and support and guidance from trusted pharmacist and physician leaders to successfully assume increased accountability for antibiotic de-escalation at the point of patient care. In addition, nurses must remember that one of the most effective ways to reduce unnecessary antibiotic use is to prevent infections in the first place. Nurses, in partnership with their infection preventionists colleagues, play a lead role in efforts to prevent healthcare-associated infections and these pre-existing influential alliances should be leveraged when implementing AS nursing practices.

**Culture (Organizational)**

Organizational culture refers simply to ‘the way we do things around here’ and represents the shared and predominant ways of thinking, feeling, and behaving. Healthcare organizations are comprised of multiple subcultures (i.e. administration, professional groupings, departments) which collectively provide supportive environments to collaborate across professional boundaries to improve patient care or unfavorable environments that promote resistance, conflict and hierarchical power struggles. Similar to successful infection prevention and control interventions, effective nurse AS interventions rely directly upon the interplay of multiple complex leadership and management systems, which in turn are strongly influenced by organizational culture. This point is illustrated by the findings from a recent large multisite study, reporting that perceived lack of a patient safety culture and limited leadership support were the primary barriers to nurse AS engagement. Practically speaking, when nurses plan to improve patient safety through AS engagement, the term culture should be explored with the interprofessional team, accompanied by explicit discussion of the role that enduring hierarchical power relations play in organizational life. A bidirectional effort is required to change a prevailing culture that AS is
solely the domain of pharmacist and physicians. Nurses must see themselves as AS team members and leaders, and in turn, physicians and pharmacists must see nurses as AS team members and leaders.\textsuperscript{46} Success relies on all disciplines embracing the value and benefits of this person-centered, interprofessional approach.

\textit{Competency (Nurse AS Competency)}

Competency is observable and measurable knowledge, skills, abilities, values, and personal attributes, reflecting expectations of education and applied experiences.\textsuperscript{47} More than 30 years ago, Patricia Benner described how ongoing, long-term career development was important in nursing due to the the evolving complexity and responsibility of nursing practice.\textsuperscript{48} Her novice to expert model postulates that nurse competence develops over time, is progressive and consists of five developmental stages: novice, advanced beginner, competent, proficient, and expert. This dynamic, situational model suggest that as nurses master lower level competencies, they move to higher level competency. However, such progression can be impacted by multiple factors including education, the complexity of experiences and professional autonomy.\textsuperscript{47} Taking a similar approach, Courtenay and colleague’s developed an AS competency model for undergraduate nursing education.\textsuperscript{49} The model consists of six competency domains (infection prevention and control; antimicrobials and antimicrobial resistance; diagnosis of infection and the use of antimicrobials; antimicrobial prescribing practices; person-centered care and interprofessional collaborative practice) and descriptors indicating the knowledge, skills and abilities expected of students for optimal use of antibiotics. Although created for undergraduate nursing education, the model can be applied to supporting learning and skill development for practicing nurses.

The peer-reviewed literature is replete with nurse-identified AS knowledge and skill gaps.\textsuperscript{21,50-51} Use of these data can guide development of targeted competency-based AS nurse education and
training programs to fill the gaps prior to launching AS initiatives. Building AS competence will enable nurses to take advantage of opportunities to confidently discuss antibiotic treatment decisions and management plans with their colleagues, patients, and patient’s families.49

**AN-P = Antibiotic Stewardship Nursing Practices Supporting the Safe and Responsible Use of Antibiotics**

Five AS nursing practices that span the healthcare delivery continuum are included in the framework. Depending on the local context and culture, each implemented practice has the potential to impact antibiotic decisions, be integrated into nurses’ daily workflow and improve patient outcomes. The practices are intended to enhance centralized AS programs and perhaps provide alternative approaches to perform AS at facilities without centralized programs or with limited resources. This is not meant to be an exhaustive practice list, but a springboard for further discussion and development. A crucial aspect to realize the benefits of each practice is a clear, concrete, and precise evaluation plan.52 Practices are described elsewhere thus a summary of each is provided here.53-54

1. **Conduct Antibiotic Allergy Assessment.** The most commonly reported antibiotic allergy is to penicillin, with about 10% of the general public being labeled penicillin allergic.55 However, about 90% of the patients with self-reported penicillin allergy are not allergic and able to tolerate penicillins.55 Treatment options for patients with unconfirmed penicillin allergy are limited, leading to greater use of broad-spectrum antibiotics which may be less effective, have more side effects and promote the development of ABR.55 De-labeling of patients with unconfirmed penicillin allergy is increasingly recognized as a key component of AS programs.56,57 From 30% to 63% of patients can be de-labeled after comprehensive interviews, and reviews of the medical
As part of standard practice, nurses directly impact optimizing antibiotic use and keeping patients safe by evaluating the patient for true penicillin allergy (IgE-mediated) by conducting a comprehensive history. The inappropriate labeling of antibiotic allergies may be mitigated by nurses’ accurate and thorough assessment and documentation of antibiotic allergies, educating the patient about the effect of antibiotic allergy labels and, as appropriate, referring the patient for further antibiotic allergy evaluation.\textsuperscript{49,53}

2. \textit{Support Accurate Microbiology Testing Practice.} The term ‘diagnostic stewardship’ applies to interventions to improve appropriate use of microbiological diagnostics to guide therapeutic decisions.\textsuperscript{59} Inappropriate use of microbiology tests, especially those ordered and obtained from patients without clinical indications, can result in misdiagnosis of infection, delay in correct diagnosis, unnecessary antibiotic use, unnecessary follow-up tests, increased length of stay, increased resource utilization, cause unnecessary stress for the patient and contribute to ABR.\textsuperscript{60,61} Core diagnostic stewardship nursing practices that directly impact optimizing antibiotic use and keeping patients safe include confirming the need for ordered microbiology diagnostics tests (eg. urine, stool cultures) when indicated, collecting samples according to the healthcare facility’s procedures and guidelines, ensuring proper handling and storage and reviewing the implications of test results with the clinical team. Evidence suggests that inappropriate ordering and collection of cultures may be mitigated by specific nurse-driven interventions. For example, review of urine culture indications by nurses in long term care and acute care settings have successfully reduced the number of unnecessary urine cultures for adults with and without urinary catheters and reduced unnecessary antibiotic use.\textsuperscript{62,63} The clinical microbiology laboratory is an essential part of the AS team. Nurses should make every effort to develop collaborative
working relationships to help guide their use of the laboratory resources and help interpretation of antibiotic susceptibility results.  

3. **Ensure Safe Antibiotic Administration Process.** Keeping patients safe prior to, during and following the antibiotic administration process is a significant nurse responsibility, especially in acute and long term care facilities. Throughout the entire medication process (prescribing, transcribing, dispensing and administering) nurses analyze the most current patient data, engage in evidence-based clinical reasoning, coordinate care with physicians and pharmacists, intercept errors before they reach the patient and, in the case of antibiotics, ensure appropriate duration. Nurses can keep patients safe from receiving unnecessarily prolonged antibiotic therapy by leading and/or participating in antibiotic “time-outs” - structured formal reassessments by the care team to determine if a modification or discontinuation of antibiotic therapy is warranted. In fact, Monsees and colleagues implemented a nurse-driven antibiotic engagement tool and found clarifying antibiotic duration a prime area for nursing stewardship efforts. Furthermore, antibiotic time-outs led by neonatal intensive care unit charge nurses led to a reduction in antibiotic usage rates, and nurse prompting in a critical care unit led to significant reductions in antibiotic use. Also, bedside nurse-driven infection prevention and AS multidisciplinary rounds in a community hospital resulted in significant reduction in antibiotic use and urinary catheter use.

4. **Educate Patients, the Public and Policymakers.** Antibiotic resistance and AS are complicated topics that are poorly understood by patients, the general public and policymakers. In the US the CDC leads ongoing efforts to educate patients and the general public about appropriate antibiotic use and most national action plans to reduce ABR include a provision to provide patient, public and policymaker education to increase awareness. Up to 95% of antibiotic use in human
health care occurs in the outpatient setting, making it an important venue to provide patient-centered educational campaigns to raise awareness. \textsuperscript{71,72} Employed across the healthcare delivery continuum, nurses, in their patient advocate role, have unlimited opportunities to assure that patients/consumers have and understand appropriate information as to be fully involved in informed decision-making regarding their antibiotic use. Ultimately, efforts to curtail inappropriate antibiotic use and reduce ABR will require a concerted effort across all sectors of society. It is imperative that patients be included in stewardship efforts. \textsuperscript{73}

5. \textit{Promote Vaccination.} Vaccination is a proven effective and safe measure to prevent many infectious diseases that affect children adolescents and adults. Vaccines have dramatically reduced the incidence of death from many infectious agents as well as reduce microbial resistance.\textsuperscript{74} Alarmingly, significant portions of the population around the world are reluctant about vaccination in general, and now more specifically for COVID-19 vaccination, despite the high risks associated with the pandemic.\textsuperscript{75} Public concerns about vaccine usefulness and safety have led to decreasing vaccine coverage prompting the WHO to list ‘vaccine hesitancy - the refusal, delay, or acceptance with doubts to vaccinate despite availability of vaccine services’ - as one of the ten most important global health threats.\textsuperscript{76,77} The primary drivers of vaccine hesitancy are lack of confidence, complacency and convenience.\textsuperscript{75} Nurses spend considerable time administering vaccines and counseling patients, families, and the public about the benefits, risks and safety of vaccines and in the face of vaccine hesitancy they remain one of the most trusted advisor and influencer of vaccination decisions.\textsuperscript{75,77-78} In their role as patient advocate and educator, nurses must be aware of the common concerns regarding immunization, be prepared to address the concerns, and carefully tailor communication and interventions to the target population and the reasons for hesitancy.
Conclusion

Antibiotic stewardship aims to reduce the emergence of ABR through local actions taken by the entire healthcare team to protect, care for and responsibly use antibiotics to prevent patient harm and optimize use in diverse clinical, social-structural and behavioral contexts. Nurses are ideally situated to provide holistic person-centered care, advocate for judicious use of antibiotics, be active stewards of sustained antibiotic effectiveness and educators of their patients, communities and the general public. One challenge to achieving full nurse engagement as equal members of the AS team is lack of an organizing framework to illustrate relationships of phenomena and concepts inherent to adoption of AS nursing practices. To fill this gap, we created the Antibiotic Stewardship Nursing Practice SCAN-P framework and invite the nursing and infection prevention communities to use, evaluate and refine the framework. Although designed for clinical practice, we believe it has applications for nursing research and education. In collaboration and full partnership with our health profession colleagues, it is time to unleash the full potential of the global nursing community to prevent patient harm from antibiotic resistant infections, optimize antibiotic use and reduce microbial resistance!

References


Antibiotic Stewardship Nursing Practice: The SCAN-P Framework

SCOPE & STANDARDS OF NURSING PRACTICE
American Nurses Association
International Council of Nurses

CONTEXT, CULTURE & COMPETENCY
Organizational Leadership
Patient Safety & Infection Prevention & Control
Knowledge, Skills, Abilities

ANTIBIOTIC NURSING PRACTICES
Supporting Safe & Responsible Use

PREVENT PATIENT HARM
OPTIMIZE ANTIBIOTIC USE
EDUCATE PATIENTS, THE PUBLIC & POLICYMAKERS
ENSURE SAFE ANTIBIOTIC ADMINISTRATION PROCESS
SUPPORT ACCURATE MICROBIOLOGY TESTING PRACTICES
CONDUCT ANTIBIOTIC ALLERGY ASSESSMENT
PROMOTE VACCINATION