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The Critical Role of the Staff Nurse in Antimicrobial Stewardship—Unrecognized, but Already There

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An essential participant in antimicrobial stewardship who has been unrecognized and underutilized is the “staff nurse.” Although the role of staff nurses has not formally been recognized in guidelines for implementing and operating antimicrobial stewardship programs (ASPs) or defined in the medical literature, they have always performed numerous functions that are integral to successful antimicrobial stewardship. Nurses are antibiotic first responders, central communicators, coordinators of care, as well as 24-hour monitors of patient status, safety, and response to antibiotic therapy. An operational analysis of inpatient admissions evaluates these nursing stewardship activities and analyzes the potential benefits of nurses’ formal education about, and inclusion into, ASPs.

Keywords. antimicrobial stewardship; antimicrobial stewardship program; antibiotic resistance; nursing; turnaround time.

The emergence and worldwide spread of antimicrobial resistance presents a global health crisis that both the US Centers for Disease Control and Prevention (CDC) and the World Health Organization (WHO) have labeled a grave threat to human health [1]. The “perfect storm” of widespread antibiotic use, pharmaceutical industry retreat from new antibiotic development [2], and spread of antibiotic resistant organisms [3], combined with rapid, accessible international travel [4] has captured the attention of healthcare professionals, national governments, the media, and the public at large. The main immediately available strategy to address this problem is the utilization of currently available antibiotics and resources in the most judicious manner to achieve the best clinical results, while limiting the development and propagation of multi-drug resistant microorganisms.

Antimicrobial stewardship is such a programmatic approach to the thoughtful use of antibiotics [5]. It is hoped that education of all healthcare providers, as well as the general public, about the rationale for antimicrobial stewardship will lead to a restraint in the use of antibiotics that was felt to be unnecessary in an earlier time when antibiotics were regarded as abundant and effective “miracle drugs.” Although conceptual guidelines for the ideal use of antibiotics were published in 1988 [6], and warnings regarding resistance to antibiotics were promulgated as far back as 1939 and 1945 [7], formal antimicrobial stewardship programs (ASPs) have developed only in the last 15 years [8]. The major currently recognized stakeholders in ASPs include

pharmacy, infectious diseases, infection prevention, and microbiology professionals, with administrative (including financial and regulatory) support [9]. The sector currently absent from the formal organizational chart is nursing.

Repeatedly, in guidelines for the development of ASPs, broad-based, multidisciplinary involvement is highlighted as an essential feature to achieve the goals of antimicrobial stewardship [10–12]. Brief mention of including staff nurses is made in these recommendations, but is limited to at most 3 or 4 sentences. In 2 articles from the United Kingdom and from Australia [13, 14] and in the Institute for Health Improvement/Centers for Disease Control and Prevention (IHI/CDC) Antibiotic Stewardship Driver Diagram and Change Package [15], comment is made about nursing functions. However, in the latter, the itemized secondary drivers are not explicitly assigned or attributed to nurses, and in the 2 infection control journal articles, the interventions are described as “should be implemented” [14] or “could impact” [13] antimicrobial stewardship efforts. We assert that staff nurses are *already* participating in these activities, albeit not in an acknowledged or integrated fashion. Because of this exclusion, they cannot contribute most effectively to the diverse goals of ASPs. The unintentional mischaracterization of the participation of nurses in ASPs as only potential rather than actual has the additional unintended consequence of divorcing nursing from those very activities that nurses need to understand as critical attributes of antimicrobial stewardship.

The dichotomy between the omission of nurses from formal ASP guidelines and the reality of daily nursing practice becomes obvious if one examines a stepwise progression through a typical inpatient hospital admission. Table 1 lists the antimicrobial stewardship activities involved in the care of patients, with the traditional stewardship stakeholders who are assigned responsibilities or credit for their operational completion. On

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arrival at the hospital emergency department, a patient is triaged and placed on appropriate precautions. This triage function is actually made by the emergency department triage nurse or by the admitting staff nurse. That decision may be reviewed or modified later by an infection preventionist, sometimes guided by microbiology results, but the immediate determination regarding necessary isolation is an established staff nursing judgment. Next, medication allergy history is assessed, either by the triage or admitting nurse. A label of penicillin “allergy” has been documented to be associated with increased antibiotic costs, increased selection of antibiotic resistant microbes, and increased length of stay and hospital costs [16]. These subsequent consequences are traditionally linked to pharmacy, microbiology, case management, and fiscally to administration, but the identification and documentation of a medication allergy history is a well-accepted staff nurse responsibility. Nurses therefore need to be taught the difference between a true allergy and the adverse events that would not preclude the use of certain classes of antibiotics. As many electronic medical record systems preserve the past history of a patient’s medication usage, the nurse’s review of past safe (or not) receipt of cross-related antibiotics (eg, cephalosporins in a patient with a history of alleged penicillin allergy) could become a useful component of “medication allergy reconciliation.”

Timely antibiotic ordering and administration, regarded as a Joint Commission National Quality Core Measure and identified as a Centers for Medicare and Medicaid Services (CMS) performance measure, is typically viewed purely as a physician prescribing event. But it is the staff nurse 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 [17]. Likewise, although cultures are also ordered by a physician, or occasionally by protocol, early and appropriate collection and submission of specimens for culture are almost universally performed by nurses. This underscores the need for nurses to be educated about how to obtain appropriate specimens for culture and then to send such specimens by protocol in suitable clinical settings without awaiting a physician order. This would include:

1. straight catheterization for urine specimens, if needed, prior to antibiotic administration in urgent admissions for possible sepsis,
2. stool testing for *Clostridium difficile* infection and stool output documentation in patients with healthcare- or antibiotic-associated diarrhea, and
3. obtaining follow-up blood cultures for gram positive cocci to capture potential high-grade, sustained duration *Staphylococcus aureus* bacteremias that could be consistent with intravascular infection.

Following the patient’s admission, the 24/7 bedside progress monitoring and reporting is unquestionably a primary nursing

function. In the first 24–36 hours of care, preliminary microbiology results exist in the laboratory but are not acted upon until recognized by the physician and updated in the pharmacy profile. Because all changes in orders by inpatient providers are directed through the bedside nurse, antibiotic timeout and de-escalation need to be routine components of antimicrobial stewardship rounds with nurses. Discontinuation of unneeded antibiotics may not occur without such review. Quality and safety measures are already identified as core nursing responsibilities by The Joint Commission [18] and by the Institute of Medicine [19]. These organizations have identified the staff nurse as the primary bedside patient advocate and the monitor for healthcare-associated infections and antimicrobial adverse events. Many such safety and quality initiatives, including reduction in central line associated bacteremia and catheter associated urinary tract infection, *Clostridium difficile* infection surveillance and control, and other “bundle” measures, are in large measure operationalized and/or tracked by nursing staff. These routine nursing functions represent the application of antimicrobial stewardship principles in daily patient care.

Antimicrobial stewardship itself is an applied discipline, more than just the promulgation of lists of evidence-based antibiotic guidelines. It acknowledges the unique repercussions of antimicrobial agents as communal medications, affecting more than just the individual patient and having an impact on future infections beyond the currently treated illness. Antimicrobial stewardship, by its very nature, has historically been multidisciplinary, originally developed by infectious diseases physicians and pharmacists, but involving almost every field of in- and out-patient care. As such, both effective communication and education are critical components of every ASP’s mission.

Throughout the in-patient stay, the staff nurse is the central communicator among ordering physicians, the pharmacy, the laboratory, discharge planners, and consultants. The nurse is also a primary information source for patients and families, reinforcing and updating information from physicians, and providing education about medications and their appropriate use. Given that between 25% and 50% of patients will receive an antibiotic during any given hospital stay, and that more than 2 million people will acquire an antibiotic-resistant infection annually in the United States alone [3], it is certain that every staff nurse will directly confront the consequences of our current antibiotic resistance crisis. Although the basic tenets of antimicrobial stewardship are widely recognized, the specifics of their application in clinical practice are local. The most obvious example of this is the microbiology antibiogram, which can vary between institutions, services, and even different units of an individual service. The formal inclusion of nurses in ASPs may stimulate individual services or units to have discussions regarding the implementation of specific operational guidelines and bedside priorities for antimicrobial stewardship within specific clinical settings. There is increasing interest in the role of

Table 1. Overlap of Nursing Activities With Function Attribution in Current Antimicrobial Stewardship Models

	Nursing	Microbiology	Case Management	Pharmacy	Infectious Diseases	Infection Control	Inpatient Physician	Administration
Patient admission								
Triage and appropriate isolation	•					•		
Accurate allergy history	•			•	•		•	
Early and appropriate cultures	•				•		•	
Timely antibiotic initiation	•				•		•	•
Medication reconciliation	•			•			•	
Daily(24 h) clinical progress monitoring								
Progress monitor and report	•		•		•		•	
Preliminary micro results and antibiotic adjustment	•	•		•	•		•	
Antibiotic dosing and de-escalation	•			•	•		•	
Patient safety & quality monitoring								
Adverse events	•			•	•		•	
Change in patient condition	•				•		•	
Final culture report and antibiotic adjustment	•	•		•	•	•	•	
Antibiotic resistance identification	•	•			•	•	•	
Clinical progress/patient education/discharge								
IV to PO antibiotic, outpatient antibiotic therapy	•		•	•	•		•	
Patient education	•				•	•	•	
Length of stay	•		•		•		•	•
Outpatient management, long-term care, readmission	•		•		•	•		•

Abbreviations: IV, intravenous; PO, per os [oral].

antimicrobial stewardship in different settings including critical care [20], oncology [21], orthopedic surgery [22], emergency medicine [23], and long-term care [24], and nursing collaboration can help broaden the base of antimicrobial stewardship acceptance.

Antimicrobial stewardship by its very nature is multidisciplinary, and it is nursing that is at the hub of communication among the participants. Early and appropriate collection of specimens for culture is the first link of a chain leading to microbiological diagnosis and antimicrobial susceptibility determination, therapeutic drug measurements, antimicrobial adjustment and de-escalation, intravenous to oral or to outpatient intravenous antimicrobial therapy, and ultimately directly to an impact on patient discharge and length of stay. Laboratory results and medication orders “chase” the patient and therefore reach the nurse at the bedside first. From an outcomes standpoint, turnaround time cannot be viewed simply as time to test completion. For true antimicrobial stewardship performance, turnaround time must impact time-to-intervention. This is true even for the effective implementation of newer, rapid diagnostic tests [25]. An illustrative example is the attempted implementation of rapid polymerase chain reaction testing and notification of methicillin resistance in *Staphylococcus aureus* infections at 2 different hospitals [26,27]. There were

entirely different provider responses to these stewardship interventions for appropriate antibiotic use at the 2 different institutions. Such disparate responses illustrate the need for nurse participation in facilitating a timely, coordinated multidisciplinary stewardship process.

The central role of nurses in routine patient care and communication makes it clear that they perform numerous functions critical to the successful operation of ASPs. A comparison of the components of antimicrobial stewardship with the routine daily responsibilities of staff nurses demonstrates an almost complete overlap. From a workflow analysis perspective, the staff nurse is the operational and communications hub for all of the multidisciplinary participants in the traditional ASP model. Improved communication is one of the primary IHI/CDC Antibiotic Stewardship Driver Diagram and Change Package components: “bring(ing) disciplines together to improve communication and collaboration about improving antibiotic use” [15]. Given nurses’ central role in this interdisciplinary communication, they provide those links that could enhance antimicrobial stewardship efficiency. Although difficult to measure, the recognition of formal nursing involvement in ASPs can serve to address efficiencies at the patient’s bedside and to improve antimicrobial stewardship process performance [28].

To date, the most prominent examples of staff nurse participation in antimicrobial stewardship-related functions have been in the realm of infection control and prevention, particularly in the implementation of catheter-associated urinary tract infection (CAUTI) and central line-associated blood stream infection (CLABSI) bundle measures. In one center, a nurse-directed urinary catheter removal protocol reduced catheter use by 50% and CAUTIs by 70% [29]. In another study, nurse reminders to physicians in intensive care units for urinary catheter removal reduced both CAUTI rates and antibiotic costs [30]. Implementation of, and compliance with, CLABSI reduction bundles, typically operationalized by nursing staff, have been shown to reduce CLABSI rates [31]. In fact, 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 that were based on interdisciplinary collaboration [32]. Once nurses are educated about, and integrated into, ASPs and empowered to participate fully in antimicrobial stewardship, research focused on their then recognized role could be performed to evaluate their impact to best enhance ASP performance.

Education about antimicrobial stewardship is important not only for physicians [33, 34] but for every healthcare discipline, as well as for public health policy makers, legislators, and for the general public. As the largest single group of healthcare providers, nurses should be included in this educational effort. Antimicrobial stewardship education is particularly important for nurses, however, who may not identify themselves as antibiotic prescribers, and therefore not view their activities as contributing to antimicrobial stewardship [35]. It is illustrative to discover that among 900 publications on antimicrobial stewardship, only 11 appeared in nursing journals [17]. It is common for nurses to be taught microbiology and sometimes even antibiotic pharmacology, as a pure, rather than as an applied science. As such, the relevance and application of antimicrobial stewardship to clinical nursing activities and their interdisciplinary relatedness is not immediately obvious. Nurses can be trained about appropriate antibiotic prescribing [36], as nurses and nurse practitioners do acknowledge their need for further education regarding the appropriate use of antibiotics [17, 37]. This educational deficit should be addressed by postgraduate and in-service educational programs; by national antimicrobial stewardship authorities (eg, CDC, Society for Healthcare Epidemiology of America, American Society of Health-System Pharmacists), academic institutions (nursing schools and teaching hospitals), and professional societies (eg, American Nurses Credentialing Center's Magnet Recognition Program).

The leadership of this educational effort logically falls to the Infectious Diseases Society of America (IDSA) and to infectious disease specialists, who are the identified champions of antimicrobial stewardship and the *de facto* leaders of the national

antibiotic resistance campaign. The IDSA's own core value strategic education goal states that "healthcare professionals will view IDSA information and educational resources as essential to their professional development in infectious diseases" [38]. This is especially relevant now in light of the IDSA's commitment to the White House Forum on antimicrobial stewardship: "to lead a nationwide effort, to elevate antibiotic stewardship to the level of widespread acceptance throughout the medical culture." [39]. IDSA committed "to leading the successful implementation of stewardship programs in inpatient settings . . . [and] . . . to develop and share educational tools and other necessary resources to insure that all key healthcare professionals are prepared to play their roles in implementing stewardship programs" [39].

We posit that the goal of nursing stewardship education is not to turn nurses into antibiotic prescribers. Rather it is to recognize and utilize established nursing functions to synergize with optimal ASP goals and outcomes. The focus of such antibiotic education would not be centered on which antibiotic and when to start, but on how best to assess patient response to therapy and to evaluate the safe and appropriate transition to oral antibiotic therapy and outpatient management. Some practical topics to cover could include: antibiotic management by protocol vs individual patient choices, the role of clinical practice guidelines, the differences between infection and colonization, the distinction between positive test results (eg, urine culture and chest x-ray reports) and active disease, and the differences between antibiotic adverse events and true antibiotic allergies. The hoped-for results of such information would include: improved timing, collection, and quality of microbiology specimens, prioritization of laboratory result communication, enhanced antibiotic de-escalation linked to patient response, and improved patient and family education about antibiotics. All of these would contribute to the establishment of a broader based culture of antibiotic stewardship.

In the annual Gallup poll on honesty and ethics in professions, the public has consistently voted nurses number one in trust and credibility for 14 of the last 15 years, ahead of physicians and pharmacists, police, and clergy [40]. Given this favorable public image and their important role in the education of patients and families [36], nurses' advocacy for antimicrobial stewardship can also serve to engage critical support for stewardship principles from the public at large. The enlistment of these respected healthcare professionals in the education and promulgation of the antimicrobial stewardship campaign among the public is imperative.

Nurses are already integral participants in antimicrobial stewardship. They need to be recognized as such, both by the nurses themselves and by the traditional stakeholders in ASPs. But if nurses are not formally integrated into the structure of ASPs, they cannot meaningfully contribute to the processes of antimicrobial stewardship and therefore cannot have as

critical an impact on time-to-intervention, efficiency, broad acceptance of antimicrobial stewardship, and outcomes [41]. Even in California, where in-patient antimicrobial stewardship is mandated by the state, only 40% of respondents in a preliminary survey reported nursing participation in their ASP committees or workgroups [Erin Epton, California Department of Public Health, personal communication]. Antimicrobial resistance is a national and global health crisis, requiring the best efforts of all healthcare professionals. The failure of ASPs to enlist the US nursing workforce of over 2 million healthcare professionals as proponents of antimicrobial stewardship is both an operational and strategic oversight. Such engagement is consistent with the Institute of Medicine's recommendation that nurses participate with other health professionals on interdisciplinary teams to promote comprehensive safe and effective care for patients [19].

Nursing is already incorporated in hospital administration, case management, quality management, and informatics. Integrating nurses into ASPs brings an additional perspective and fosters acceptance of antimicrobial stewardship principles. As was true with Florence Nightingale's historic example of nursing engagement leading to innovations in infection control, bedside nursing experience can not only help improve clinical outcomes but could also identify novel patient care improvements that can translate to other healthcare disciplines [42]. As a coordinated effort of all providers, improved antimicrobial stewardship can lead to better patient and public health outcomes.

Notes

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