American Journal of Infection Control 47 (2019) 230–233

Contents lists available at ScienceDirect

American Journal of Infection Control

journal homepage: www.ajicjournal.org

Major Article

Knowledge, attitudes, and practices of bedside nursing staff regarding antibiotic stewardship: A cross-sectional study

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Key Words:
Antimicrobial stewardship
CDC core elements

Background: Nursing engagement in antibiotic stewardship programs (ASPs) remains suboptimal. The purpose of this study was to determine the knowledge, attitudes, and practices of nursing staff members regarding ASPs and identify barriers to their participation in such programs.

Methods: This cross-sectional study was conducted at Virginia Commonwealth University Health System, an 860-bed tertiary care academic center located in Richmond, Virginia, where a well-resourced ASP has been in place for 2 decades. A survey consisting of 12 questions was administered to nursing staff via REDCap (Research Electronic Data Capture) in February 2018.

Results: A total of 159 survey responses were included in the study. The results demonstrated gaps in knowledge regarding antibiotic stewardship (AS) and highlighted the importance of improving communication between nurses and ASPs. Overall, 102 (64.15%) of the study participants indicated familiarity with AS. Time constraints and concerns over physician pushback were identified as major barriers to participation.

Conclusions: Many nurses were unaware of our center's ASP. Nurses identified activities falling within their daily workflow as potential areas for contribution to ASPs. Key barriers to participation were also identified. These data will inform efforts to engage nursing in AS activities at our medical center.

BACKGROUND

Antibiotics are a crucial element of modern medicine. These drugs allow for the successful treatment of infections that were once deemed fatal and have facilitated advancements in fields such as oncology and transplantation.[1] However, it is estimated that 20%-40% of antibiotic use is suboptimal in acute care units in the United States.[1] Negative consequences of antibiotic use include *Clostridium difficile* infection, adverse drug reactions, and emerging resistance among microorganisms.[1] According to a Centers for Disease Control and Prevention (CDC) estimate, over 2 million people are infected with multidrug-resistant organisms (MDROs) annually, leading to approximately 23,000 deaths.[1] Antibiotic stewardship (AS) is a crucial strategy to prevent the emergence of MDROs and to conserve the effectiveness of antibiotics.[2-4]

Promoting the judicious use of antibiotics has been dubbed a patient safety concern and national priority by the CDC.[1] A one-size-fits-all strategy does not apply when designing antibiotic stewardship programs (ASPs), and AS policies must be informed by local factors such as antibiotic resistance patterns, rates of infections caused by MDROs, and antibiotic consumption.[1] The following core elements are recommended by the CDC to build a successful ASP: leadership commitment, accountability for program outcomes by appointing a single physician leader, drug expertise provided by a pharmacist leader, assessing continued need for antibiotic treatment at set points in time, monitoring antibiotic restriction and resistance patterns, reporting antibiotic use trends and resistance patterns, and educating hospital staff about the judicious use of antibiotics.[1]

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Conflicts of interest: None to report.

https://doi.org/10.1016/j.ajic.2018.09.008

It is recommended that ASPs involve a multidisciplinary team that includes physicians, pharmacists, microbiologists, nursing staff, and information technology personnel among others.[1,5] While the role of nurses in AS has been highlighted by the CDC, their role has not been fully explored.[1,6,7] By virtue of their clinical responsibilities, nurses hold a critical position in patient care.[6,8] The American Nursing Association recently published a white paper exploring the potential role of nurses in AS. These include assessing the source of infection and elucidating details of drug allergies upon initial patient assessment, obtaining blood cultures prior to antibiotic administration, initiating antibiotics in septic patients promptly, adjusting and de-escalating the use of antibiotics by communicating microbiology results to physicians, monitoring for adverse events related to antibiotics, reviewing orders for antibiotics, performing "time-outs" and assessing the need for ongoing antibiotic use at predetermined time intervals, assessing for transition to oral antibiotics if applicable, educating patients and reconciling medications, and communicating with staff at other facilities for changeover in the event that patients are transferred to a different hospital or long-term facility.[6]

At present, nursing staff is not formally integrated into ASPs in most states, and nursing representation at national AS meetings is minimal. Moreover, AS training is usually not incorporated into nursing education programs.[9] As a result, nurses are often unfamiliar with the concept of AS and may be insecure about their knowledge of antibiotics and AS core principles.[6] There is a need to highlight the role of nurses in AS, as specified by the CDC and Joint Commission. This can be accomplished by educating bedside nurses regarding specific goals of ASPs, involving nurses in stewardship rounds, identifying nursing champions at the unit level, and developing programs to disseminate key microbiology and pharmacology concepts relevant to AS.[6,8] Moreover, highlighting the benefits of ASPs to nursing staff may help nursing engagement in these programs.[6] Through this study, we surveyed nurses to explore their knowledge, attitudes, and practices regarding AS and to identify barriers and gauge their willingness to participate in AS-related activities. The results of this study will inform our local efforts to engage nursing in AS.

METHODS

This cross-sectional study was conducted at Virginia Commonwealth University Health System (VCUHS), a tertiary care, 860-bed hospital in Richmond, Virginia, with a well-resourced ASP in place for approximately 20 years. A mandatory online AS module for nurses was introduced in October 2017. This touched upon concepts of antibiotic resistance, CDC core elements of AS, and contact details for the VCUHS ASP. By March 2018, about 95% of nurses had completed the module. Other efforts to increase nursing awareness regarding ASPs included teaching by infection preventionists during nursing meetings.

A literature review was performed using PubMed to identify all existing studies on AS for nurses. Using these resources, and utilizing feedback from ASP pharmacists and VCUHS infection preventionists, we developed a survey to assess the knowledge, attitudes, and practices of nurses regarding AS, as well as to identify barriers to nursing participation in ASPs. The study was approved by the VCUHS Institutional Review Board (IRB) and was administered via REDCap (Research Electronic Data Capture).

The study population comprised all nurses employed at VCUHS regardless of age, gender, years of experience, educational background, and areas of practice within the hospital (n = 3,485). Personal information including name, employee code, work emails, and demographic data for study participants was not collected. An email invitation with a link to access the survey was sent out in February 2018. No informed consent was obtained prior to survey administration. Responses were voluntary, anonymous, and confidential and implied consent for participation in the study. The survey contained a total of 12 questions. Six of these assessed knowledge regarding AS while the remaining 6 explored prior AS training, knowledge regarding the ASP at VCUHS, and barriers to nursing participation in AS. Question formats included "choose the best answer," "choose all that apply," and "rate on a Likert scale from 1-5." All survey responses received within 2 weeks were included in the study. Surveys with any missing responses were excluded. Proportions of responses were determined for each question.

RESULTS

A total of 164 nurses accessed the online survey and submitted responses. Five surveys (3%) were submitted as incomplete and were excluded from the study. Of the study participants, 102 (64.2%) indicated familiarity with the concept of AS. Only 31 (19.5%) indicated having received formal training for AS. When inquired about potential participants in ASPs, 152 (95.6%) correctly identified physicians, 148 (93.1%) identified pharmacists, 158 (99.4%) identified nurses, and only 118 (74.2%) recognized the role of information technology personnel. Over 90% of the participants correctly identified education, regular reporting, and monitoring of antibiotic prescription and resistance patterns as core elements of ASP activities. Gaps in knowledge regarding other core elements were noted: dedication of necessary resources was identified correctly by 105 (66.0%), appointing a single physician leader by 66 (41.5%), appointing a single pharmacist leader by 76 (47.8%), and the use of tools such as antibiotic time-outs was identified by 137 (86.2%) participants (Table 1).

Ranking the magnitude of emerging resistance as a health care problem on a scale of 1 to 5 (1 being nonurgent, 5 being extremely urgent), 82 (51.6%) scored it as a 5 while 2 (1.3%) scored it as 1. Forty-four (27.7%) respondents identified the percentage of inappropriately prescribed antibiotics in acute care hospitals as 21%-40%, while 69 (43.4%) picked 41%-60%.

Only 120 (75.5%) of VCUHS nurses were aware that an ASP existed at VCUHS, and 19 of these reported having interacted with an ASP member previously; among these 19, 12 reported understanding of how to contact ASP members. Participants were not required to demonstrate how to contact the ASP. On a scale from 1 to 5 (1 being unlikely and 5 being very likely to participate in ASPs), 64 (40.3%) chose 5 while 6 (3.8%) chose 1 (Fig 1).

A total of 136 respondents (85.5%) indicated that time constraints were a major potential barrier to nursing participation in ASPs, and 112 (70.4%) indicated concerns over physician pushback (Table 2). The percentage of responses regarding potential roles of nursing staff in ASPs has been summarized in Table 3.

Table 1
ASP core elements and the percentage of participants who identified them

ASP core elements	Responses n = 159 (%)
Dedicating necessary resources	105 (66.0)
Appointing a single physician leader	66 (41.5)
Appointing a single pharmacist leader	76 (47.8)
Implementing at least 1 recommended action such as antibiotic time out	137 (86.2)
Monitoring antibiotic prescribing and resistance patterns	154 (96.9)
Regular reporting information on antibiotic use and resistance patterns	146 (91.8%)
Educating staff members about resistance and optimal prescribing	154 (96.9)

ASP, antibiotic stewardship program.

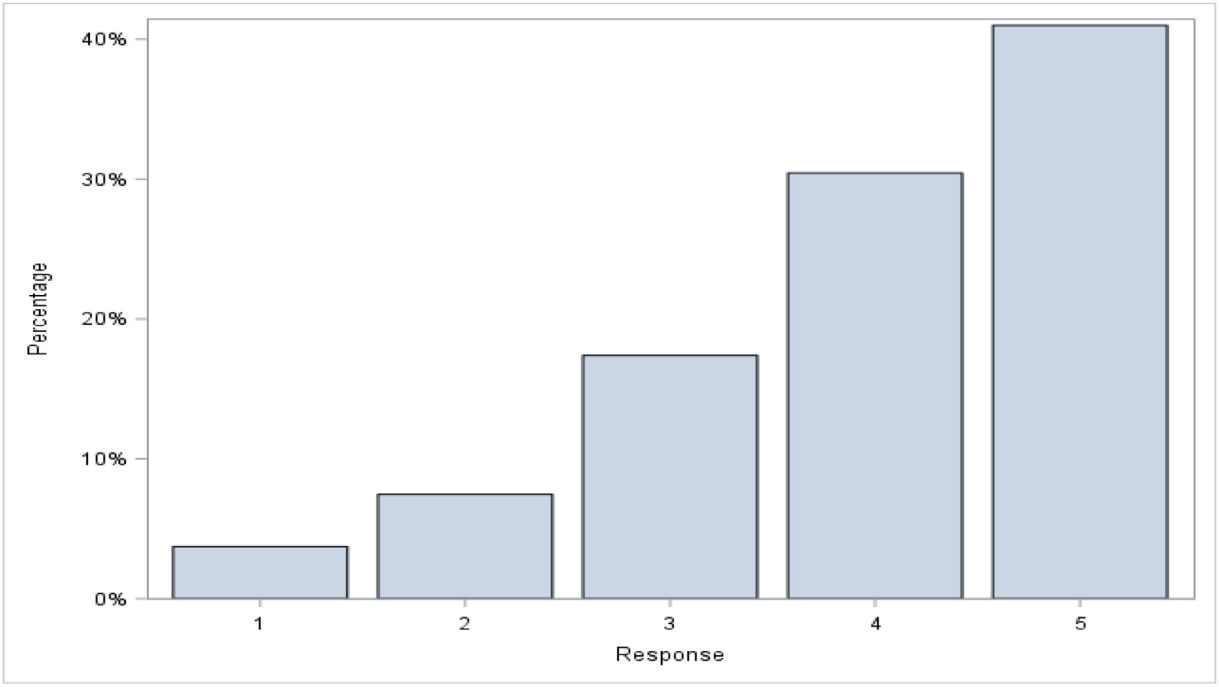

Fig. 1. Responses to the question, "How likely are you to participate in ASPs on a scale of 1 to 5 (1 being unlikely, 5 being very likely)"? ASP, antibiotic stewardship program.

DISCUSSION

This is among the first surveys in the United States to assess the knowledge, attitudes, and practices of nurses and to identify barriers to their participation in ASPs. Our study assessed the knowledge of nurses regarding the magnitude of the antibiotic resistance problem, the percentage of unnecessary antibiotics prescribed in the health care setting, past interaction with our ASP, knowledge on how to contact the program if needed, potential nursing roles in AS, and knowledge regarding the CDC core elements of ASPs. We also identified potential barriers to nursing participation in AS activities. Over 64% of our survey responders indicated familiarity with the term "antibiotic stewardship." This is much higher than in prior ASP nursing surveys with about 30%-40% of bedside nurses indicating familiarity with ASPs.[10,11] As reported in previous studies, a large percentage (81.5%) of survey respondents reported no history of AS training.[10,11] Only 75% of the respondents were aware of the ASP program at VCUHS. Over 80% had not communicated with the VCUHS ASP previously and were unsure how to contact the program. For a hospital with a well-resourced ASP program, established approximately 2 decades ago, this highlights the gaps in communication with nursing staff. In the context of a recently mandated online ASP-produced nursing module introduced at VCUHS, this may indicate that education through online courses is not viewed as "ASP training" and either the education module should be modified or supplemented by activities such as engagement of nurses in AS team rounds and meetings. Importantly, most respondents (99.4%) recognized a role for nurses in ASPs alongside physicians and pharmacists. Nurses picked activities falling into their daily workflow, such as triage, allergy history assessment, review of MDRO flags, antibiotic administration, and drawing cultures prior to antibiotic initiation, as potential areas for participation in AS activities. Activities requiring interaction with prescribers were not favored as potential areas for nursing contribution to ASPs. Time constraints and pushback from physicians were identified as major potential barriers to nursing participation in ASPs and may explain the choice of potential nursing roles in ASPs.

Table 2
Barriers to nursing participation in ASPs

Potential barriers to nursing participation in ASPs	Responses n = 159(%)
Time constraints	135 (84.9)
Physician pushback	111 (69.8)
Scope of practice concerns	107 (67.3)
Knowledge of microbiology	103 (64.8)
Knowledge of antibiotics	101 (63.5)

ASPs, antibiotic stewardship programs.

Table 3
Potential roles of nursing staff in ASPs identified by survey respondents

Potential bedside nursing roles in ASPs	Responses n = 159 (%)
Patient education about antibiotics and/or infection	150 (94.3)
Cultures prior to antibiotic initiation	148 (93.1)
Timely initiation of antibiotics if indicated	145 (91.2)
Allergy history assessment	138 (86.8)
Patient admission and triage (eg, reviewing flags for multidrug resistant bacteria colonization and placing in isolation when appropriate)	135 (84.9)
Reviewing stop dates for antibiotics	114 (71.7)
Ensuring antibiotic durations and indications are recorded in discharge paperwork	113 (71.1)
Reviewing final cultures and discussing antibiotic de-escalation with treating physician	97 (61.0)
Daily progress monitoring with assessment of need for continued need for antibiotic therapy	96 (60.4)
Medication reconciliation	94 (59.1)
Reviewing preliminary culture results and discussing antibiotic de-escalation with treating physician	88 (55.4)
IV to PO conversion of antibiotics	82 (51.6)
Antibiotic dosing	56 (35.4)

ASPs, antibiotic stewardship programs; *IV*, intravenous; *PO*, by mouth.

Delitt et al were among the first to publish guidelines for AS in 2007,[3] They recommended a multidisciplinary approach for the success of such programs. Since then, studies addressing nursing knowledge, nursing education, their information needs, and patient safety assessments through antibiotic management have been conducted. In a cross-sectional study, McGregor et al surveyed nurses and midwives from 9 regions in Scotland regarding AS.[12] Of the 514 survey responders, 36.8% (n = 189) considered AS an appropriate role for nursing staff; 26.3% (n = 109) reported knowledge gaps and 42% (n = 183) identified workload as a barrier to participation in ASPs. Almost one-half of the participants indicated the need for further support to improve participation in such programs. In another study, Olans et al evaluated the understanding of bedside nurses regarding ASPs. Data were collected via a focus group discussion with a pre- and post-focus group survey. The roles identified for nursing inclusion in ASPs included obtaining cultures, reviewing and reporting microbiological culture data, de-escalating antibiotics, assessing for infection, differentiating infection from colonization, and encouraging nurses to voice questions and concerns as physicians prescribe antibiotics.[13] Abera et al surveyed physicians and nurses at 13 hospitals in Ethiopia to evaluate knowledge regarding emerging resistance to antibiotics. Of the 210 responding nurses, 68.5% (n = 144) reported having received current information in AS and only 9.3% (n = 36) of the study participants reported having received training in the area.[14] In a recent multicenter study, a survey was conducted to assess the knowledge of nurses regarding ASPs, identify barriers to their participation, and explore preferred sources of obtaining information regarding ASPs. Four hundred respondents (93%) agreed that a discussion regarding change of antibiotics with the prescribing physician once cultures are finalized is likely to benefit patients. Respondents identified participation in ASPs, including scope of practice concerns, lack of knowledge and lack of time constraints as barriers to participation in such programs.[10] In another study, assessing the knowledge of nursing staff regarding AS, a total of 75% correctly answered knowledge-based questions regarding ASPs.[15] The study participants then completed educational modules online. Eighty-six percent of the knowledge-based questions were correctly answered in the post-test. The change in scores was statistically significant ($P < .001$). As in these studies, the results of our survey underscore the need to educate nurses regarding AS. As noted in several studies, online modules may represent effective educational tools. Our experience indicates that these alone may not be sufficient. Discussions in nursing huddles, lecture series, and readily accessible cellular phone apps and pocket cards are other educational methods that may be used.[10,15]

This study was designed to obtain a snapshot of AS awareness among VCUHS nurses and identify barriers to their participation in such programs. It also allowed for us to gauge the success of our mandatory online ASP-developed nursing module at VCUHS. Survey brevity was a major strength.

Limitations of our study include its single-center, cross-sectional design. This survey was administered to nursing staff at a tertiary care hospital with a well-resourced ASP established approximately 2 decades ago and the results may not be generalizable to nonacademic centers or those without ASPs. Another limitation of our study is our lack of ability to determine the true survey response rate. The survey invitation was released via a list serve serving 3,485 nursing staff; however, we are unable to determine the true number of active nursing staff reached. These data may therefore not be representative of the entire nursing body at VCUHS. We also did not obtain demographic information for study participants. This may represent an area that can be explored in future studies.

CONCLUSIONS

The results of this survey highlight the need to provide education to nursing staff about AS, including information regarding ways nurses can promote AS in the context of their day-to-day activities. Additionally, institution-specific ASP information, including ways to contact personnel, are also important areas in which education can be focused. As front-line staff members in patient care, nursing engagement in AS presents great opportunities for ASPs. Addressing barriers to participation and lending support to nurses is likely to improve participation in ASPs.

Our study addressed emerging antibiotic resistance and explored the role of nurses to optimize ASPs. To our knowledge ours is the first survey to address nursing knowledge of the specific CDC core elements of AS. We identified key areas in which nurses can engage in AS and identified key barriers to participation, as well. These data will inform our efforts to engage nursing staff in AS at our institution.

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