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Exploring the nurses' role in antibiotic stewardship: A multisite qualitative study of nurses and infection preventionists

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Abstract

Background—There is a growing recognition of the need to partner with nurses to promote effective antibiotic stewardship. In this study, we explored the attitudes of nurses and infection preventionists toward 5 nurse-driven antibiotic stewardship practices: 1) questioning the need for urine cultures; 2) ensuring proper culturing technique; 3) recording an accurate penicillin drug allergy history; 4) encouraging the prompt transition from intravenous (IV) to oral (PO) antibiotics; and 5) initiating an antibiotic timeout.

Methods—Nine focus groups and 4 interviews with 49 clinical nurses, 5 nurse managers, and 7 infection preventionists were conducted across 2 academic pediatric and adult hospitals.

Results—Nurse-driven antibiotic stewardship was perceived as an extension of the nurses' role as patient advocate. Three practices were perceived most favorably: questioning the necessity of urinary cultures, ensuring proper culturing techniques, and encouraging the prompt transition from IV to PO antibiotics. Remaining recommendations were perceived to lack relevance or to challenge traditionally held nursing responsibilities. Prescriber and family engagement were noted to assist the implementation of select recommendations. Infection preventionists welcomed the opportunity to assist in providing nurse stewardship education.

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Conclusions—Nurses appeared to be enthusiastic about participating in antibiotic stewardship. Efforts to engage nurses should address knowledge needs and consider the contexts in which nurse-driven antibiotic stewardship occurs.

Keywords

Nurses; antibiotic stewardship; qualitative research

Antibiotic resistance is a global health threat, and both national and international efforts have underscored the need to slow antimicrobial resistance. In 2014, the Centers for Disease Control and Prevention (CDC) called for hospitals to have antibiotic stewardship programs,[1] defined as coordinated evidence-based efforts to optimize antibiotic use.[2] In 2016, at the 71st United Nations General Assembly, world leaders pledged to combat the spread of resistance,[3] and since 2017, hospitals have been mandated by the Joint Commission to implement antibiotic stewardship programs.[4] However, the implementation of stewardship programs has principally focused on prescribers and pharmacists. Nurses have been largely absent from stewardship efforts, with 1 multisite study finding that only 38% of inpatient, clinical nurses were aware of the phrase “antibiotic stewardship.”[5]

Recently, several editorials have advocated for the formal inclusion of nurses in antibiotic stewardship efforts.[6–9] This is due to nurses’ widespread involvement in activities that directly relate to antibiotic use and the belief that an absence of partnership with nurses limits the success of antibiotic stewardship programs. Nurse-driven antibiotic stewardship can involve a host of activities (eg, effective assessments, antibiotic de-escalation, and timely culturing practices). However, nurses’ perspectives on the specific stewardship activities that should be targeted and strategies of how to best engage nurses in stewardship efforts are limited.

In July 2016, the CDC and the American Nurses Association (ANA) cosponsored a full-day conference in Silver Spring, Maryland, in which 30 nurses from around the United States discussed strategies to promote nurse-driven antibiotic stewardship and to identify specific nurse-driven antibiotic stewardship activities. A report of the conference, as well as activities of the working group, are detailed in the white paper copublished by the CDC and the ANA.[10]

The purpose of this descriptive qualitative study was to explore the attitudes of nurses and infection preventionists (IPs) toward 5 of the nurse-driven antibiotic stewardship activities recommended by the ANA/CDC working group. Specifically, that nurses may play a major role in optimizing antibiotic treatment by: 1) questioning the medical necessity of urine cultures; 2) ensuring proper 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. These practices were selected beccause they offer a comprehensive approach to improved antibiotic use. In particular, proper culturing procedures foster patients’ receipt of indicated targeted therapy; the prompt switch from IV to PO may result in shorter inpatient stays[11]; accurate drug allergy histories promote optimal therapy[12]; and antibiotic timeouts have been shown to decrease empiric antibiotic therapy.[13] We were interested in 1) participants’ attitudes

regarding the belief that nurses should play a major role in antibiotic stewardship; 2) challenges to nurses' ability to perform recommended practices; and 3) ways to address identified challenges. We also spoke with IPs, all of whom were trained nurses and held nursing education responsibilities, since they would likely offer a unique perspective on this topic.

METHODS

From March to May 2017, we conducted focus groups and semi-structured interviews with clinical nurses, nurse managers, and IPs who worked in general intensive care units (ICUs) and medical-surgical units of 2 academic hospitals that provide care to adult or pediatric populations in New York City. Convenience sampling was used to recruit participants; nurses and IPs of participating medical-surgical units and ICUs were informed of the study via email distributions and flyer postings. To accommodate participants' varied work schedules, we provided the option of participating in either a focus group or a semi-structured interview in person and in a private room (ie, conference room, staff lounge, or personal office) that was convenient and accessible to participants. Clinical nurses were interviewed separately from nurse managers to facilitate open and honest dialogue. We ceased study recruitment when we reached theoretical saturation, meaning that participants' contributions were repetitive of earlier conversations, and no new information was obtained.

To assist conversation, we used an interview guide piloted by clinical nurses prior to formal data collection. A nurse researcher with a background in qualitative methods (E.C.) led the interviews and focus groups. An advanced practice nurse (A.S.) was present at focus groups and took field notes of contextual information and general impressions of discourse. Discussions were recorded and transcribed using a professional transcription service. All transcriptions were reviewed for accuracy.

Data were coded by 3 members of the research team (E.C., A.S., and A.B.) using a conventional content analysis in which data were grouped according to codes derived from transcripts in NVivo software (http://www.qsrinternational.com/nvivo/nvivo-products). To ensure consistent coding procedures, nearly 25% of transcripts were independently coded by 2 researchers; the application of codes was compared and discrepancies were discussed and resolved by consensus. This study was deemed exempt by Columbia University Medical Center's institutional review board.

RESULTS

We conducted 9 focus groups and 4 interviews with 49 clinical nurses, 5 nurse managers, and 7 IPs. All IPs had worked as clinical nurses. Thirty-seven (61%) participants worked in the adult setting, and 24 (39%) worked in the pediatric setting. All participants had obtained a bachelor's degree, and 13 (21%) had obtained a master's degree. The clinical experience among participants was: 29 (47%) >10 years; 15 (25%) 1-5 years; 14 (23%) 6-10 years; and 3 (5%) <1 year.

Overarching attitudes regarding the nurses' role in the optimization of antibiotics

Participants agreed that nurses should play a major role in antibiotic stewardship. They reasoned that nurses' contributions to optimize antibiotics were an extension of the nurses' role as patient advocate. A nurse manager said, "Our responsibility is to advocate for the patient, so if we could find a way to limit the amount of…antibiotics that go into the patient…we should…it's highly important that we get involved." Participants also maintained that nurses are ideally positioned to optimize antibiotic use given that they are the principal administrators of antibiotics and a constant presence at the patient's bedside. A pediatric nurse in the ICU stated, "We're the ones at the bedside that are…questioning things and catching things…if we were more involved, we would…advocate for the patient and…appropriate use."

However, a minority of participants expressed reservations regarding the role of nurses in antibiotic stewardship, noting that patients in their care were acutely ill and required antibiotics. A pediatric medical-surgical nurse said, "By the time [patients] get here, they're…in danger of meningitis…[In the] outpatient, [antibiotic stewardship is] super-important…[for a] cough or sneeze…people [are] taking Z-Pak. …Here, it's kind of hard." Participants questioned nurses' ability to make valuable contributions to antibiotic stewardship due to nurses' limited role in antibiotic prescribing and the belief that antibiotic orders are vetted by multiple personnel (eg, prescribers, pharmacists, and infectious disease) prior to a nurses' administration of antibiotics.

We report participants' perceptions toward each of the 5 recommended nurse-driven antibiotic stewardship practices separately below. Because findings were consistent across IPs, nurse managers, and clinical nurses, we present a summary of findings across professional roles. Regarding recommended practices, certain perceptions differed between participants in the adult and pediatric setting and are described below.

Recommendation #1: Nurses may play a major role in antibiotic stewardship by questioning the medical necessity of urinary cultures

In the pediatric setting, this recommendation was noted to lack relevance as participants reported that urine cultures were obtained only when medically indicated. In the adult setting, this recommendation was met with general support but was perceived to present 2 major challenges: unaddressed knowledge needs and prescriber pushback. Regarding knowledge needs, participants described uncertainty regarding the indications for urine cultures, especially among patients unable to express symptoms of urinary tract infection due to their medical condition (eg, mechanically ventilated or comatose patients). Regarding prescriber pushback, while some participants reported that they would feel comfortable questioning a prescriber about the indication for a urinary culture, many believed that such a line of questioning would be met with resistance because it might represent an unwelcomed expansion of nurses' scope of practice. To overcome these challenges, participants suggested that nurses receive education on appropriate indications for urinary culture and that these indications be articulated in a guideline or institutional policy that nurses would be able to reference when discussing the appropriateness of urine culture orders with prescribers.

Representative quotes of recommendation challenges and corresponding strategies are presented in Table 1.

Recommendation #2: Nurses may play a major role in antibiotic stewardship by ensuring proper techniques when collecting a culture

This recommendation was received with overwhelming support by participants in adult and pediatric care settings. Participants said this practice was considered a "priority," while acknowledging that nurses were one of several types of professionals to obtain cultures and that nurses could not speak to or oversee the techniques of other professionals. IPs too reflected that this recommendation was "Completely appropriate" and "Good nursing practice." In the pediatric setting, the acts of obtaining blood cultures via a central line or urine cultures via straight catheterization were viewed with particular caution, as these procedures were perceived to increase a patient's risk for subsequent infections. One pediatric nurse described, "Anything that's supposed to be sterile…that's something we take very seriously on this unit…We don't like…predisposing these kids…to added risks."

Despite the prevailing belief that proper culturing technique is an essential nursing practice, respondents acknowledged that several challenges existed. A lack of ongoing formal education in proper blood and urine culturing techniques was perceived as the principal contributor to inconsistent and suboptimal techniques during specimen collection. Participants reported that nurses' knowledge of proper techniques was largely gained informally through clinical experiences and, to a lesser-extent, during formal in-services provided by IPs, nurse educators, and clinical nurse specialists. Participants subsequently recommended that nurses receive formal education regarding these activities during dedicated skills days and for educational content to be reinforced on an ongoing basis. IPs welcomed the opportunity to support such education. Still, some clinical nurse participants reported that formal training may be unnecessary for experienced clinical nurses, who were perceived to exhibit proper techniques.

Additional challenges expressed included a lack of accountability regarding proper techniques, a lack of awareness that inappropriate culturing techniques could adversely affect proper selection of antibiotic treatment, and the pushback of patients' families, particularly in the pediatric setting (who may encourage the use of noninvasive methods to obtain cultures when invasive methods are indicated). To facilitate nurse accountability, participants recommended that informal and formal audits be conducted on sterile technique procedures in which nurse peers, educators, and IPs would monitor and correct improper practices in real time. To improve nurses' awareness regarding the effect of culturing techniques on the proper selection and ordering of antibiotics, participants recommended that education emphasize the importance of the "why" behind proper culturing techniques and the implications for patient outcomes. To overcome the pushback of patients' families, participants recommended that families' receive education on the effect of appropriately obtained cultures on antibiotic treatment. Representative quotes describing challenges to this recommendation and corresponding strategies to address them are presented in Table 2.

Recommendation #3: Nurses may play a major role in antibiotic stewardship by obtaining and recording an accurate penicillin drug allergy history

This recommendation states that nurses use their clinical judgment to interpret and record a patient's self-reported penicillin allergy as either a true drug allergy or intolerance (depending on the patient's reaction) in the patient's record. However, participants across care settings expressed the opinion that these actions were outside the nurses' scope of practice and may lead to patients' receiving an antibiotic that they indeed had an allergy to, and therefore would be difficult to implement. One IP likened nurses' responsibilities related to drug allergy assessments to nurses' assessment of patients' pain; specifically, information reported by patients is intended for nurses to document in the medical record. To assist in accurate drug allergy assessments, participants recommended that nurses inquire about the signs and symptoms of reported drug allergies, document these signs in the medical record, and initiate conversations with prescribers when reported drug allergies are suspect. To assist nurses in these functions, participants suggested that nurses be provided with an educational algorithm to specify the differences between true allergic reactions and drug intolerances. Of note, nurses in the pediatric setting said that penicillin drug allergies are rare in their setting but agreed that they too would not feel comfortable overriding a reported drug allergy for the reasons previously described. Representative quotes of recommendation challenges and corresponding strategies are presented in Table 3.

Recommendation #4: Nurses may play a major role in antibiotic stewardship by encouraging the prompt transition from IV to PO antibiotics

Participants across care settings expressed overwhelmingly positive attitudes toward this recommendation, which was perceived to benefit both patients and nurses. This recommendation proposes that nurses use their clinical knowledge to initiate conversations with prescribers when an IV antibiotic could be appropriately switched to the PO route. In terms of patient benefits, nurses said that the prompt use of PO rather than IV antibiotics may decrease a patient's hospitalization and aid in patients' comfort, as patients would not have to be attached to an IV pole during antibiotic administration and would likely be more familiar with their antibiotic drug regimen when discharged to home. In terms of nurse benefits, participants in the adult setting said that PO antibiotics were less time-consuming to administer than IV antibiotics (although the opposite was said among pediatric patients, who may be unable to tolerate PO antibiotics) and noted that this practice gave them an opportunity to make a meaningful difference in a patient's treatment regimen. One nurse stated, "Most nurses want to have those kind of communications [with] the prescriber."

Challenges to this recommendation included knowledge gaps, prescriber pushback, and patient-level considerations. Regarding knowledge gaps, nurses said that they were unaware of the specific antibiotics that had the same strength IV and PO and subsequently recommended that they receive education in this area. Regarding prescriber pushback, nurses described that the IV-to-PO switch is considered in the context of patient discharge, and prescribers may be reluctant to switch to a PO antibiotic since PO antibiotics may be considered less effective. Regarding patient-level considerations, nurses mentioned that this recommendation may not be suitable in the ICU, as patients often cannot tolerate PO or there are concerns about gastrointestinal malabsorption. To overcome nurse knowledge

needs and prescriber pushback, participants recommended that nurses and prescribers receive education on the antibiotics that have the same strength IV and PO. Representative quotes of recommendation challenges and corresponding strategies are presented in Table 4.

Recommendation #5: Nurses may play a major role in antibiotic stewardship by initiating an antibiotic timeout

This recommendation proposes that nurses initiate a conversation with prescribers 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. Participants felt that such conversations were already occurring between prescribers and thus felt this practice would lead to duplicative work. A medical-surgical nurse said, “I don’t think it would happen, to be honest. The doctors…are really on top of checking [culture] results…” While participants stated that nurses should not be responsible for leading antibiotic timeout discussions, participants felt strongly that nurses should be part of antibiotic-related conversations but also stated that nurses’ ability to contribute to these conversations is confined given limited antibiotic-related knowledge.

To facilitate nurses’ ability to engage in meaningful conversation related to antibiotics, participants recommended that nurses receive education on how they may contribute to the optimization of antibiotics. Participants routinely reflected that during their basic education they were trained in the 5 rights of medication administration: administering the right drug, to the right patient, at the right dose, at the right route, and the right time. They suggested that these rights be adapted as an algorithm that encompasses the intricacies of antibiotic use, including antibiotic de-escalation. In describing the benefit of such an algorithm, an adult medical-surgical nurse said, “To have it on paper and for everyone to follow the same procedures would be much better….” Representative quotes of recommendation challenges and corresponding strategies are presented in Table 5.

DISCUSSION

In conducting interviews and focus groups with frontline nurses, nurse managers, and IPs across 2 hospitals that care for pediatric and adult patients, we found that nurses are enthusiastic to partner in antibiotic stewardship efforts but describe several barriers that challenge their ability to perform recently recommended activities. Namely, in our sample of participants who had received bachelor’s or master’s degrees, knowledge gaps regarding antibiotics were consistently said to pose a substantial barrier to nurses’ implementation of recommended stewardship practices. These knowledge gaps are likely attributable to system-level educational gaps at the pre-licensure and post-licensure level. Pre-licensure, education in antibiotic resistance and antibiotic stewardship is absent from the core curriculum of baccalaureate nursing education.[14] Post-licensure, continuing educational requirements vary by state, and courses on antibiotic resistance and antibiotic stewardship have not been specified.[15] In the absence of such mandatory education, nurses’ receipt of antibiotic or antibiotic stewardship-related education is contingent on the expertise and interest of the faculty curriculum committees within each nursing program or on the interests

of an individual nurse. Participants subsequently recommended that nurses receive ongoing education to meet existing knowledge needs, a recommendation that is consistent with studies that show that rehearsed or revisited knowledge is better retained.[16,17] In addition to formal education, the need for educational tools (eg, practice guidelines and algorithms) that nurses could readily reference at the point of care were highlighted. Together, these findings suggest that additional education on antibiotic stewardship is warranted pre- and post-nurse licensure, and that action-oriented, evidence-based materials should be developed and available to nurses in their work environments. However, we are not aware of any publicly available training materials that have been designed to educate hospital-based nurses in the United States on their roles in and responsibilities for antibiotic stewardship. Evidence-based, nurse-centered antibiotic stewardship training materials are needed.

Most nurses expressed favorable attitudes toward playing a major role in antibiotic stewardship. Despite nurses' limited exposure to antibiotic stewardship, they could readily appreciate their role in optimizing antibiotic use and perceived stewardship responsibilities as an extension of their role as the patient's advocate. While a lack of time and increased workload are commonly cited as barriers to the integration of evidence into practice,[18,19] participants did not seem to perceive their contributions to antibiotic stewardship as additional work but rather as an opportunity to improve and add value to the work that they already perform.

Three recommendations were viewed most favorably by participants: questioning the need for urinary cultures; obtaining cultures using proper collection techniques; and initiating the switch from IV to PO antibiotics. Nurses' active participation in these activities is likely to assist in the optimization of antibiotics, especially since studies have found that improper urine culturing procedures result in unnecessary and prolonged antibiotic treatment[20] and that the early switch from IV to PO antibiotics reduces the duration of IV antibiotics[21] and inpatient hospital stays.[22]

The 2 other recommendations were met with resistance as they were perceived to exceed the nurses' scope of practice (in the case of ensuring an accurate penicillin drug allergy history) or to lack relevance in participants' settings (in the case of initiating an antibiotic timeout). These findings suggest that proposed recommendations may need to be adapted according to local needs and cultures and highlight the need for frontline nurses to be engaged in the identification and implementation of nursing practices that have potential for intervention. While participants felt that nurses should not be responsible for deciphering a true drug allergy, since traditional training educates nurses to document and not override a patient's reported drug allergy, participants reported that nurses have an important role in the process by probing patients with knowledgeable and validated questions concerning their allergy symptoms, documenting patients' responses in the medical record, and communicating questionable reported drug allergies to prescribers. As evidence of the importance of these nursing practices, a recent study found that a third of reported drug allergies were missing allergy reaction information in the medical record.[23]

Additional challenges to the implementation of recommendations included a lack of emphasis on the link between nursing practices and patient outcomes and anticipated

prescriber pushback. While participants clearly recognized that blood draws from central lines increased the patient's risk for infection, the connection between nursing practice and inappropriate antibiotic use was not clearly recognized by participants. Efforts to engage nurses in antibiotic stewardship should focus on nurses' role in improving patient care and outcomes, an approach that has succeeded in minimizing healthcare-associated infections.[24] Regarding prescriber pushback, participants highlighted the need for prescriber support for recommendations that were perceived as expanding nurses' traditional scope of practice and responsibilities (ie, questioning the appropriateness of urinary cultures and initiating the switch from IV to PO antibiotics). In particular, participants drew parallels between these stewardship recommendations and recently implemented catheter-associated urinary tract infection prevention guidelines, in which nurses were empowered to discontinue unnecessary urinary catheters, yet said that feelings of discomfort and a lack of prescriber support impeded this practice.[18] Hence, the successful implementation of nurse-driven stewardship practices must take into account the context in which the practices occur, including nurses' and prescribers' abilities to negotiate well-accepted social and professional roles.[25]

To our knowledge, this is the first study to engage a diverse group of stakeholders across the pediatric and adult settings to explore specific recommended nurse-driven antibiotic stewardship practices. Strengths of this study include the use of verbatim transcripts and our coding approach, which improved study rigor. Still, this study was conducted at 2 academic teaching hospitals in New York City, and findings may not be generalizable to other institutions.

In conclusion, nurses expressed a desire to become active partners in antibiotic stewardship and perceived their partnership as an extension of their role as the patient's advocate. Unaddressed knowledge needs were perceived to pose the greatest challenge to nurses' ability to partner in antibiotic stewardship efforts. There remains a need for nurse-tailored antibiotic stewardship training materials to support nurses' active partnership in antibiotic stewardship programs. IPs may assist in the provision of nurse education.

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Table 1

Representative quotes, challenges, and strategies regarding the recommendation that nurses play a major role in antibiotic stewardship by questioning the medical appropriateness of urine cultures

Challenges	Suggested strategies to overcome challenges
Unaddressed knowledge needs *"We need…a very strong guideline I mean, if I see sediment…I would probably say that you may be want [to] send something."* Discomfort questioning prescriber orders *"It's [going to] require them, to…know the questions to…then ask the questions. …I'm sure that there is some comfort level among some of the nurses but…whether they feel like they know enough to even question the order…it might a little bit anxiety-producing to question the order."*	Provide formalized training to nurses and a guideline that specifies indications for urinary culture *"I think, especially for newer nurses…on the nightshift…they don't have the sense yet of [asking] 'Why are we actually doing this?' and have that conversation. They might not feel…empowered to do that yet…if we had…formalized teaching, and it was very explicitly…discussed, like, 'These are the steps that you should take,' I think that would empower the…new nurses on the unit, as well."* *"It's a little more tricky when you're trying to fight for something or advocate for something [and] there is nothing you can point to as a reference…"* *"Any 15, 30-minute in-service on just refreshers on what to look out for…is beneficial. It's always good to do that."*

Table 2

Representative quotes, challenges, and strategies regarding the recommendation that nurses play a major role in antibiotic stewardship by ensuring proper technique when collecting a culture

Challenges	Suggested strategies to overcome challenges
Lack of ongoing formal education in culturing techniques *"Depending on who trains you and what your experience is, you're [going to] learn from one person how to do something."*	Provide formal training on technique *"Any kind of education or demonstration is a good thing, and it should be standard everywhere across the board…may be yearly, just a refresher."*
Lack of accountability regarding proper techniques *"I think people are aware. I think sometimes if you get really busy, you do things a little rushed…you might skip one step…"* *"People…think that they're doing things the right way."*	Conduct formal and informal audits to ensure proper sterile technique *"So we tag team, and we help each other so that we also have another person there seeing that sterility is maintained, and you feel comfortable with each other to be like…'You need to change your gloves.'"*
Lack of awareness of negative consequences that result from poor culturing technique *"I have to be honest with you. I don't know that…I've thought about it…quite in that way…[A]s I'm drawing blood…or obtaining a culture, to think. …may be antibiotics won't be necessary"*	Emphasize the importance of the "why" behind nursing practices and the implications of nursing care on patient outcomes *"In the in-service where you're educating us…[say]…okay this is why we're doing this…if we're not collecting samples correctly patients have longer stays and poorer outcomes…"*
Family push-back *"A lot of the times, for urine, it's…optimal to get a catheterized sample, but a lot of the times… parents…don't want that… they'll refuse that, so then you end up having…to do a clean catch or something like that."*	Educate caregivers on the need for cultures to ensure proper antibiotic treatment *"Occasionally…parents don't want us to stick their child. They [say], 'The reason they have this line is for the blood draws.'But if we do get a culture from the line, and we don't get a peripheral culture, how do we know if it's throughout their whole body or just the line?"*

Table 3

Representative quotes, challenges, and strategies regarding the recommendation that nurses play a major role in antibiotic stewardship by obtaining and recording an accurate penicillin drug allergy history

Challenges	Suggested strategies to overcome challenges
Outside the nurses' scope of practice *"I think it's really tricky for the nurse because I think you say, 'What are your allergies?' and they tell you. And then you say, 'What's your reaction when you have them?' and they tell you. And you know that this is really a sensitivity, and this patient is not allergic to X, Y, or Z, and how [can the nurse] be the person to test that?…I've never fought with [a] family or a patient and said, 'Well, that's actually more of a sensitivity and wouldn't—we wouldn't classify that as an allergy." …I've never had that conversation, and I've never known of anyone who's had that conversation…"*	Nurses should ask patients to describe the signs and symptoms of reported drug allergies, document these in the medical record, and initiate conversations with prescribers when reported drug allergies are suspect *"Nurses can ascertain more information. If I'm interviewing a patient, and the patient tells me that she's had penicillin administered in the past and had swelling to her whatever, throat, difficulty speaking, broke out in rash, I can ascertain that that's a true allergy. If a patient then tells me that they were told they had an allergy as a kid, then that's another conversation. Then yes, maybe I can speak to the doctor and say, 'We might want to think about desensitizing the patient or checking to see if the patient has a true allergy to penicillin,' [because] then maybe penicillin is an option."*

Table 4

Representative quotes, challenges, and strategies regarding the recommendation that nurses play a major role in antibiotic stewardship by encouraging the prompt transition from intravenous to oral antibiotics

Challenges	Suggested strategies to overcome challenges
Knowledge needs *"There [are] knowledge gaps in knowing what, specifically, those antibiotics are that have kind of equivalent strength, IV to PO."* *"We would do it, if we knew [which meds] they were…"*	Educate nurses and prescribers on those antibiotics that have the same strength when given orally or intravenously *"Education would be needed for providers and for nursing, on what…those antibiotics would be…. this is the same PO, so we could use that."*
Prescriber push-back *"I don't think medical teams are very comfortable with …a PO option, initially…if somebody's in-house admitted with some kind of infection, I think they'd rather [give] the IV antibiotics…it's when patients are starting to wrap-up to go home, they're [prescribers are] trying to bundle that stuff up."*	
Patient-level considerations *"A lot of [our patients] have malabsorption issues…so I think some of that too is an issue with switching to the PO. Or we have [patients with a] bowel obstruction…where we're doing IV meds because we can't do PO."*	None discussed.

Table 5

Representative quotes, challenges, and strategies regarding the recommendation that nurses play a major role in antibiotic stewardship by initiating an antibiotic timeout

Challenges	Suggested strategies to overcome challenges
Lack of perceived value to nurse-initiated antibiotic time-outs as antibiotics are already closely monitored by prescribers and pharm D *"The doctors…are continuously talking about the same patients over and over, so they're… really following it…[we] also have the pharm D on the floor… "*	Specify and provide guidance on the specific elements of antibiotic management that nurses should review *"You have nurses that want to be a part of it, and then try to be, but it really just depends…I agree that we need… an algorithm, and we need to educate ourselves, [because] otherwise we're not going to feel…empowered."*
Knowledge gaps *"We're not there with antibiotics. We're not knowledgeable enough to have that conversation…."*	*"They would have to give us that information, train us, become aware, okay. 'Vancomycin is for this…For this condition it's given for ten days. For this condition it's given for two days.' We'll have to know. To be able to [contribute]."*

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