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Pediatric Nurses' Perceptions of Their Role in Antimicrobial Stewardship: A Focus Group Study

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ABSTRACT

Purpose: To explore pediatric nurses' perceptions of their role in antimicrobial stewardship.
Design and methods: Twelve focus group sessions were conducted at a freestanding children's hospital including 90 nurses across a range of settings, units, and years of experience. Transcripts of the focus group sessions were jointly coded, from which themes were developed.
Results: Specific nursing roles in antibiotic stewardship identified include: (1) advocating for the patient, (2) communicating with the team, (3) administering medications safely, (4) educating caregivers, and (5) educating themselves. Identified barriers hindering effective execution of these roles include inconsistent inclusion on rounds and lack of institutional protocols for antibiotic use.
Conclusion: Nurses easily identified numerous daily nursing tasks that fit within the framework of antimicrobial stewardship and desired additional education and engagement in antibiotic stewardship.
Implications: Engaging nurses could improve the structure of antibiotic stewardship programs and break down the barriers that keep nurses from fulfilling their role.

Introduction

Antimicrobial stewardship refers to a coordinated effort to improve appropriate antibiotic prescribing "by promoting the selection of the optimal drug regimen, dose, route, and duration of therapy" (Barlam et al., 2016; Dellit et al., 2007) and reducing unnecessary antibiotic use. Formal hospital-based antimicrobial stewardship programs have been increasingly described over the past two decades (Gross et al., 2001) and are now considered standard of care (Barlam et al., 2016). The core action strategies of antimicrobial stewardship programs in the acute care inpatient setting include developing and implementing institution-specific clinical pathways detailing choice of antibiotics for specific conditions; identifying opportunities to optimize drug, dose, duration, and route of antimicrobial therapy; providing education to providers, patients, and their families on appropriate antibiotic use; and restricting prescribing for selected antimicrobials (Dellit et al., 2007). The efforts of formal antimicrobial stewardship programs have been proven to prevent medication errors, reduce health care costs, reduce *Clostridium difficile* infection rates, shorten hospital length of stay, and reduce antimicrobial resistance (Fishman, 2006; Fishman, 2012; May et al., 2000; Seppälä et al., 1997; White Jr. et al., 1997).

Nurses have not yet been formally included as partners in institutionalized antimicrobial stewardship programs (Barlam et al., 2016; Dellit et al., 2007). This may pose a significant oversight, as nurses are crucial to many key antimicrobial stewardship activities (Olans et al., 2016). Nurses have the most frequent contact with the patient, are involved in all aspects of the patient's care, and are in a unique position to fully ensure that all patient care needs are met when an antibiotic is prescribed. The Joint Commission's Antimicrobial Stewardship Standard, which became effective in 2017, includes educating nurses on antimicrobial stewardship (The Joint Commission, 2016), yet does not specify the optimal content of such education. Nor did it describe how nurses themselves can be *sources* of knowledge for improved care, rather than solely recipients. The objective of our study was to explore pediatric nurses' perceptions of their role in antimicrobial stewardship. A more clearly defined role for clinical nurses in antimicrobial stewardship activities could enhance antimicrobial stewardship practices and promote a culture of safety.

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Methods

Study population

Pediatric nurses were invited to participate in focus groups if they were employed as a clinical nurse at the study site. As our goal was to specifically evaluate the clinical bedside nurses' perceived role in antimicrobial stewardship independent of prescribing, we excluded nurse practitioners from the study population. Additionally, we aimed to include clinical nurses from across the hospital. No specific clinical area was excluded, but unit-based focus group sessions were targeted at clinical units where antibiotic prescribing was more likely.

Nursing leaders from the clinical units were contacted via email and asked to assist in scheduling focus group sessions in their respective areas. We also partnered with unit-based shared nursing leadership councils to schedule sessions. To incentivize participation, we offered catered meals for each focus group session. In addition to the clinical unit sessions, we also scheduled focus groups with the system-level shared nursing leadership councils; these groups were representative of nurses from multiple clinical services. To facilitate scheduling of focus group sessions and increase the likelihood of participation, sessions were often scheduled during previously scheduled shared nursing leadership council meetings for both unit- and system-level councils.

Questionnaire

A brief six-question questionnaire was provided to collect information about each participant's level of education, years of nursing experience, primary nursing unit(s) of employment, and shift schedule. The questionnaires did not collect any identifying information from participants.

Focus group discussion procedures

Focus group discussion questions were developed by the study team based on literature from previous quantitative and qualitative research studies. Each study team member reviewed questions for relevance and structure and to ensure the open-ended questions solicited perceptions about the role of the clinical nurse in antibiotic use, practices, and antimicrobial stewardship.

Discussions were scheduled to last for 1 h. Two female nurse educators who are experienced facilitators led the discussions, one in the role of facilitator and one in the role of observer. The facilitators asked the open-ended questions to stimulate group discussion. Some examples of questions to prompt discussion included “How do you view the role of nurses in the use of antibiotics?”, “Do you feel you have a voice in the practices of prescribing antibiotics? Why or why not?” and “What can you do as a nurse to improve antibiotic practices?” (Table 1).

Table 1
Focus group questions.

1. Are any of you familiar with the phrase *antimicrobial stewardship*? What does the phrase mean to you?
2. How do you view the role of nurses in the use of antibiotics?
3. Do you feel you have a voice in the practices of prescribing antibiotics? Why or why not?
4. What can you do as a nurse to improve antibiotic practices?
5. Can you tell us about a time you were uncomfortable with a prescribing practice you noticed?
6. Can you tell us about the training and education you have received on antibiotic use?
7. What do you do to advocate for your patient with regards to antibiotic prescribing practice (e.g., a switch from intravenous to oral antibiotics)?
8. What antibiotic prescribing practice considerations do you discuss with your team (e.g., availability, cost, line access)?
9. What is your role in educating the patient and family on antibiotic use during hospitalization and discharge?

Following each focus group, the research team held debriefing sessions and revised the questions as needed. Focus group meetings were audiotaped and transcribed.

Data analysis

In-person meetings were held to jointly read transcripts and identify major themes. After applying first-level codes to key phrases (Charmaz, 2006), the codes were grouped with overlapping meaning and co-occurrence into themes and subthemes (Krippendorff, 2013; Kuper, Reeves, & Levinson, 2008). We created grouped classifications of phrases from the transcripts to develop a code dictionary. If there were any disagreements, we discussed them and adjudicated until arriving at consensus. For the first several focus groups, we read each recorded transcript to apply codes and to group them into themes and subthemes to ensure consistent coding between research team members. After the first four focus groups, we reached agreement and consistency in coding and theme grouping. For the remaining eight focus groups, at least two research team members coded transcripts. We included all 12 focus groups held despite having achieved saturation with a fewer number because each focus group was conducted in a separate nursing unit, we elected a priori to include all nursing units to understand issues that may be specific to a particular nursing unit or patient population. We followed Consolidated Criteria for Reporting Qualitative Research guidelines (Tong, Sainsbury, & Craig, 2007).

Ethical review

The hospital's institutional review board reviewed this study and determined it not to be human subjects research. All participants provided verbal consent to participate in the focus group discussion and to be audio recorded as part of the study. To protect the privacy of participants, we did not collect identifying information.

Results

A total of 90 pediatric nurses participated in 12 focus groups. Nurses' years of experience ranged from 9 months to 31 years, with a median of 4 years. The focus groups were held between July 2017 and January 2018, with a median duration of 28.5 min (range, 19.1–41.5). The median number of nurses participating in each focus group was seven (range, 4–13).

Ten separate focus groups sessions were conducted among the clinical units: (1) short-stay unit; (2) general pediatric unit; (3) surgical unit; (4) neonatal intensive care unit (NICU); (5) pediatric intensive care unit (PICU); (6) cardiac intensive care unit (CICU); (7) neurosciences unit; (8) gastrointestinal service unit; (9) heart and kidney unit; and (10) hematology and oncology unit. Two focus groups sessions were completed with the system-level nursing leadership councils, the practice council and resource council.

We found wide variation in participants' familiarity with the term “antimicrobial stewardship.” Some participants easily defined the term and its rationale, while others had not previously heard the term. Despite these differences, once the term was more clearly defined, participants in all focus groups agreed that the nurse has a central role in antimicrobial stewardship. Across the board, participants from all focus groups agreed that there was a need for the integration of nurses in antimicrobial stewardship. As one PICU nurse remarked, nurses “are the ones monitoring the patient” and serve as “a testimony of how [prescription and discontinuation] affects the patient.” She further remarked that nurses serve as advocates for patients at risk of sepsis, making sure to order stat antibiotics when needed; to remind physicians about the 48-h rule-out; to pay attention to which antibiotics have a stop date; or to align the current prescription with the most recent lab results.

Some of the nurses who agreed on the importance of their role in antimicrobial stewardship had displayed initial hesitation at the beginning

of the focus group. For example, one pediatric surgical unit nurse initially proclaimed that nurses have a "limited role in the prescribing and/or use of antibiotics." He drew a clear line between what he saw as the physician's role in prescribing and the nurse's role in administering the prescription. Yet following some discussion of examples brought up by nursing colleagues in the focus group, that same nurse was able to provide additional examples of his role in antibiotic stewardship and stated,

> Sometimes you find yourself being the one to remind … a physician … [to] check the [antibiotic] levels so that you can let the physician group know we need to adjust it this way or that way. I think that's also a role of any other health care provider working the patient, but most importantly for nurses that are actually giving medication to always remember that we have a role in also guiding our colleagues in the best use of these medications.

Nurses named a number of specific roles they play in the day-to-day antimicrobial stewardship, which we categorized into five themes and describe more fully below. In brief, these themes are (1) advocating for the patient, (2) communicating with the team, (3) administering medications safely, (4) educating caregivers, and (5) educating themselves (Fig. 1).

Advocating for the patient

Within the theme of advocating for the patient included subthemes: questioning the plan, ensuring best route of administration, advocating to discontinue antibiotics, and recognizing sepsis.

Questioning the plan

Clinical nurses described their role of promoting appropriate antibiotic use as "speaking up for their patients" by querying the physician's rationale when they were uncomfortable with the plan. One general pediatrics ward floor nurse stated that it was her role to question anything that "doesn't look right," and that she therefore would look up the medication's appropriate usage and make sure she understood the need for its prescription. Nurses reported that they might suggest alternatives or escalate concerns if needed.

One nurse in the focus group from the practice council noted that in cases of complex diseases such as those seen in the NICU, the physician's team does not always have "the broader view of what is going on." She gave the example of a patient in the NICU with a number of central venous catheters who developed a wound that dehisced. In this example, she highlighted the nurse's role in making sure that an antibiotic is prescribed to cover any potential infection related to the wound that may have been overlooked by the physician team.

Some nurses specified that they would only advocate if the issue at hand met a certain threshold. One pediatric surgical unit nurse noted that because "you're not prescribers you don't make that decision," but that "when you see something wrong, you'd speak up." Some nurses concurred that their willingness to question an antibiotic course would be related to the gravity of the concern. In the focus group from the resource council, two nurses from different units agreed that for a "gross error" they would readily contact the physician and felt confident that their voice would be well heard; however, for protocol deviations that did not clearly pose harm to the patient, they would be less likely to voice their input.

One experienced hematology and oncology unit nurse described being "not shy" about certain cases, such as one in which her patient developed febrile neutropenia: "I called the fellow and said 'We need to add [vancomycin] because he has a shunt'"—a recommendation in line with institutional guidelines for febrile neutropenia. This example indicates that nurses' experience and knowledge of institutional protocols may increase their confidence and willingness to speak up.

Ensuring the best route of administration

Nurses' advocacy for their patients includes observing changes in their patients' status to best plan the route of medication administration. They are in a unique position to do so, by virtue of their relationships with their patients and their caretakers. One general pediatrics ward floor nurse spoke of advocating to the physician team to consider the palatability of oral antibiotics. She remarked, for example, that the antibiotic clindamycin "tastes nasty" and that children

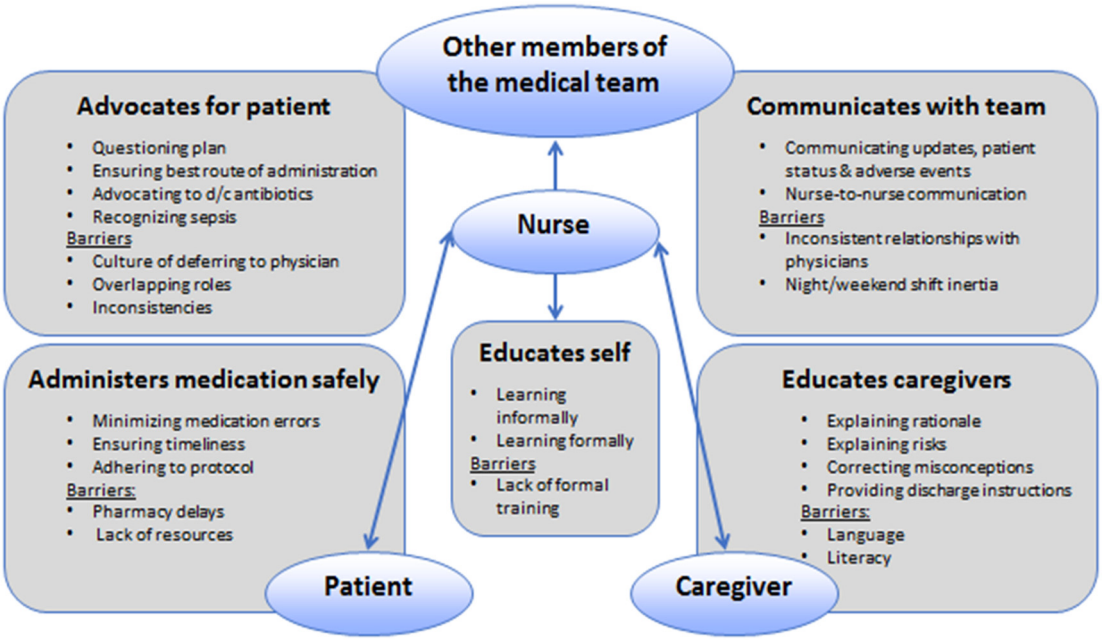

Fig. 1. Key themes for nurse's role in antimicrobial stewardship.

often refuse to take it. She pointed out that physicians might prescribe an unpalatable liquid oral solution even though the child may be old enough, with some training, to swallow a pill. In such situations, she would ask the physician if there was an equally effective alternative drug in pill form, thereby increasing the chances of the patient's adherence to the medication, a key component of effective antimicrobial stewardship.

Nurses also provided examples of the pivotal role they play in managing their patients' central venous access. Nurses emphasized that they were the most qualified team members to appreciate their individual patients' vascular access needs. In this role, depending on what is best for the patient, nurses may advocate for more stable venous access or advocate to transition from an intravenous (IV) route to oral route of antibiotic. One NICU nurse described an example of how she considers the administration of her patient's medication: "If this baby is going to have a lengthy antibiotic dosing, and the baby is going through IVs, then maybe we need to get more central access." In another case, a PICU nurse stated more bluntly, "We are putting the patient's actual physical vasculature at risk." She also noted the challenges of being what she described as "that last line of advocate for the patient" while also managing multiple medications and remaining aware of different interactions between the medications.

Nurses also identified a role in promoting the transition from IV to oral antibiotics when feasible. One nurse from the heart and kidney unit stated that she would ask, "Can we switch to PO so they can go home?" and noted she would often be the one to alert the team that an IV antibiotic may be "the only thing keeping them in the hospital." By raising the question about transition from IV to oral antibiotics, the nurse can alert the team that the patient may no longer need to remain in the hospital. One general pediatrics ward nurse explained that her questions about extended IV use are what prompted the team members to discuss whether the patient is ready to transition to oral antibiotics.

Advocating to discontinue antibiotics

Nurses identified that in certain situations they advocate for the discontinuation of antibiotics. This includes being vigilant about the duration of antibiotics and reminding the physician team about discontinuation. Nurses described checking cultures and the physicians' documented plans for duration of therapy and suggesting discontinuation of antibiotics when feasible to prevent antibiotic overuse.

One neurosurgical unit nurse noted: "If we give a patient vancomycin pending culture results, the nurses track that so that we stop them as soon as we realize we don't need them." A colleague added that she reviews labs to monitor culture results in order to discontinue antibiotics that are no longer necessary. Nurses thus emphasized their role in monitoring laboratory results, which can identify opportunities to discontinue, de-escalate, or otherwise tailor antibiotics as necessary.

Advocating for discontinuation does not always necessitate calling and monitoring lab results; at times, nurses will raise the issue of discontinuation based on following written records. One gastroenterology ward nurse noted: "When they say that they're doing a 14-day-course and it's day 15, and then I call and ask why we are still giving this medication." A nurse from the CICU provided a similar example: "I think sometimes [the reason] why our patients are on antibiotics is lost in translation. If somehow the number of days gets shuffled around or it's not passed on in a report and we don't tend to look back, I'll find that child is on antibiotics with no known reason." She concluded that her role in advocating regarding antibiotics becomes more prominent as the case progresses from the original prescription plan, and that raising the issue during rounds prompts the team to reevaluate.

Considering physical changes in the patient's appearance as a key symptom of sepsis

Recognizing sepsis was identified in every focus group as pivotal to the clinical nurses' role as it relates to appropriate antibiotic use. Nurses reported that they would vocalize the need for broader antibiotic coverage based on physical appearance and anticipation of future problems. One hematology/oncology unit nurse stated:

> We had a patient yesterday who just was looking bad. Nursing brought it to the provider's attention. They ended up adding [gentamicin] and we all thought he was going to be in the PICU but he looks much better today. It was something that wasn't very specific, even vital sign change. *It was how he looked*.
>
> This example highlights the nurses' unique position to appreciate subtle clinical changes in their patients.

Barriers to fulfilling the role as an advocate

Deference to the physician. While many nurses identified questioning the treatment plan as part of their role, a few voiced reluctance to do so, out of trust or a culture of deference to physicians. One general pediatrics ward nurse stated, "I would never question the academic team. … I feel safe in their decision-making." She provided examples of hearing very rational explanations for treatment decisions that were based on protocol and trusting that the physicians she works with have a rational "basis" for their treatment plans.

Overlapping roles. While many nurses embraced their role contributing to proper antibiotic use, a few identified the presence of a pharmacist on the team, whose role in antibiotic stewardship is more clearly defined, as a competing force detracting from the nurse's contribution. One nurse on the heart and kidney unit stated, "In terms of … selecting the antibiotics, I don't think we play a role in that. … We have a unit-based pharmacist in rounds every day, so she guides that." One PICU nurse concurred: "I definitely think that our pharmacist in rounds actually has a much bigger say in that than we do." She concluded that when the pharmacist is present on rounds, he or she would review microbiologic culture data and antibiotics and provide recommendations; she noted that the pharmacist's recommendations are often heeded by the medical team, and the nurse does not feel the need to provide input since that role is being filled by the pharmacist.

Inconsistent inclusion on rounds. Daily rounds were identified as the ideal time to start a dialogue about antibiotics with the team and understand the rationale for the treatment plan. As one CICU nurse noted, "I think rounds is when you're going to discuss it because if you didn't bring it up in rounds it's probably not going to come up again." The major barrier identified, however, was that on noncritical care units, the nurse was not consistently included on daily rounds. A general pediatrics ward nurse lamented, "Sometimes, they don't even call you for rounds. Sometimes you catch them in the act and you can jump in the rounds and interact then." At other times, though, "you miss them altogether."

Inconsistent relationships with physicians. Several nurses noted that receptiveness to their input varied by physician and was often dependent on their existing relationship with the physician. Several nurses from various units noted decreased comfort with initiating dialogue or raising concerns about antibiotics with physicians with whom they do not have an existing relationship.

This theme was also raised through examples of nurses expressing increased confidence that their input would be appreciated by a known attending physician rather than by a resident physician. One general pediatrics ward nurse noted, "I feel more comfortable talking to our [hospitalist team] doctors. … I feel like they're more

open to listen to what I'm saying compared to if I call a resident." Another nurse from the same unit expressed frustration that providing input or questioning a plan with a resident physician may not be as fruitful given the hierarchy of the medical team. She alluded to residents' insecurity in their own knowledge as a potential barrier to acting upon a nurse's concern. She stated, "They have a mentality that they are above us with education—that they know better than us. … they don't necessarily escalate [our concerns] in fear of looking like they're incompetent even though everybody is learning. …. So I get push back from them." She went on to explain that resident physicians would proceed with the plan enacted by the attending physician "but they can't explain … rationales."

Communicating with the team

Nurses see themselves as the central member of the care team in a unique position to communicate with all stakeholders to implement a unified plan of care. As the hub of the care team, the nurse can serve as a liaison and communicator to and between various members of the health care team. This includes communicating with all team members on daily rounds, reporting clinical or laboratory updates to other team members as they become available, interacting with the pharmacist, and ensuring complete and adequate communication with other nurses. One surgical unit nurse explained that she would often be the first to see the documented recommendations from the infectious diseases consultation service that may recommend a change in antibiotics. She also noted that she reviews culture data and if she sees that cultures are negative, she calls the physicians to alert them to the results, because "sometimes, they don't look at results."

Communicating updates on patient status and medication adverse events. Several nurses remarked that they "are the ones monitoring the patient" and are in the best position to serve as "a testimony of how [starting or stopping the antibiotic] affects the patient." Examples provided include noticing that a patient did not have a change in clinical status after an antibiotic course was started for "possible" infection, as well as noticing a subtle clinical change after an antibiotic was discontinued. Nurses were also keenly aware of antibiotic-related adverse events and noted that monitoring for and reporting medication adverse events is an important component of the nurse's role. In one example, a CICU nurse noted the importance of ongoing monitoring in real time for potential nephrotoxic effects of medications prior to administering subsequent doses that may need to be dose-adjusted for renal impairment:

> When you get your lab results back, if your creatinine is rising you want to make sure that before you give the next dose of the renal-toxic antibiotic, that we're [asking]: Do we need to readjust these? … Or do we want to scale back for renal dosing? And just be aware of all the different things that go into dosing the antibiotics.
>
> She concluded that nurses "have to *be the keepers of the big picture.*"

Communicating with other nurses

Nurses emphasized highlighting information about antibiotics to nursing colleagues during handoff as important to effectively communicating concerns and outstanding tasks. This was especially emphasized by nurses who work during night shift or weekend shifts. One gastroenterology unit nurse noted the importance of "passing it on to your day shift nurse," remarking, "Even though you've already talked to the doctor and the resident [and] they'll say we'll pass it on, you have to … relay information to the day shift so that when they go to the meeting they can [ask] why are we doing this." She concluded that changes in management "are not going to happen overnight."

Barriers to fulfilling role as communicator

Consulting services may not loop in the nurse. Nurses expressed the importance of their role in communicating knowledge, as they considered themselves to be central to all clinical information pertaining to their patients. However, they noted that communication was not always bidirectional, as consulting services did not always loop them in to the dialogue pertaining to antibiotics. One CICU nurse noted that she always tries to engage the infectious diseases consultation team in discussion when they come to the patient's room, but the team "would go straight to the fellow and not necessarily update the nurse on their thoughts. I think if we could help them talk to nurses also, that would be really helpful." This desire to be fully informed about any recommendations pertaining to their patients was also expressed by a surgical unit nurse who stated, "I really like to be informed" and she would like for them to come explain to her their assessment and rationale for recommendations.

Weekend and night shift inertia. Several nurses identified a theme of medical decisions not being made over the weekend or overnight, as decisions are being deferred to the patient's primary team. One gastroenterology unit nurse provided this example:

> I've had patients before where we had set a 14-day course or 21-day course, then all of a sudden it's day 16 or day 23. I reach out to the doctor saying, "Why are we still giving this medication?" There had been times where [the response was that] we will follow up with the fellow on Monday because we were not sure, but we'll just keep giving it until then. … It seems like we're just tacking on days if it's not totally necessary. It happens a lot on nights and weekends when no one wants to make a decision. It becomes: Kick the can down the road; the team will decide on Monday. We'll just keep doing what we were doing even though it becomes day 14, 15, 16 when it was supposed to stop at day 12.
>
> Nurses highlighted the importance of thorough and effective nurse-to-nurse communication in these situations.

Administering medications safely

The identified theme of administering medication safely included subthemes: minimizing medication errors, ensuring timeliness, and adhering to protocol.

Minimizing medication errors

The nurse's role of administering medication safely minimizes errors and risks in antibiotic delivery by adhering to protocols and ensuring timeliness. Regarding this role, one CICU nurse stated, "I think of nurses as a huge safety net, not only for antibiotics but for a lot of other things. We are the stopgap for a lot of possible errors, and especially with antibiotics, I think that being attuned to peak and trough, indication for use, applying the five rights [the right patient, the right drug, the right dose, the right route, and the right time] to your patient." She added that the nurse's role in minimizing errors requires the nurse "to feel empowered and assertive to speak."

Ensuring timeliness

Nurses emphasized the importance of prompt administration of antibiotics to a patient, especially for a critically ill or septic child. Nurses confront several systemwide technology and pharmacy-related barriers to timely administration of emergent antibiotics. However, nurses saw it as their role to overcome these barriers. One PICU nurse provided examples of calling the pharmacy repeatedly to ensure that antibiotics are delivered as soon as possible. She highlighted the importance of entering safety event reports whenever an antibiotic is not delivered in a timely manner.

Nurses also emphasized the importance of clear nurse-to-nurse handoff as it relates to timeliness of antibiotics. One outpatient nurse from the practice council focus group identified this as an important role for nurses in terms of good antibiotic stewardship; especially "when the patient is going from one area to another," it is important to state "what antibiotics you gave and at what time." She noted that a barrier to ensuring timeliness is that the documentation of timing of drugs administered on the medication administration record may not always be clear when a patient is transferred from one setting to another. She emphasized that clearly stating the times that drugs were given at the time of handoff should then be used so that the accepting nurse can "calculate on their end to make sure that the next dose is given at a safe interval."

Adhering to protocol

Some nurses relayed that their role in confirming adherence to institutional protocols was impeded by inconsistent and nonadherent prescribing practices. For example, one hematology/oncology nurse stated that treatment plans are frequently "attending-specific" despite the existence of specific protocols such as for febrile neutropenia in the oncology patient population. She told a story of antibiotics "starting and stopping, starting and stopping," based solely on different attending physicians coming on and off service and each one's preference for the neutrophil count cutoff for stopping antibiotics. She concluded that the "inconsistency in the doctors' preferred practice" can be harmful to the patient in such situations, and she emphasized that "having a consistent protocol" would be "better for practice to make sure these things aren't missed or switched without evidence behind it."

Educating caregivers

Across all focus groups, participants defined a role of the nurse to educate patients and/or their families and caregivers. Nurses stated that they fulfill this role by tailoring education to parents and families, explaining the rationale for antibiotics, describing the risks of a medication, correcting misconceptions, and reviewing discharge instructions.

Several nurses appreciated the greater impact of educating families, acknowledging that the words they speak to patients' parents trickle downstream to patients' communities. One PICU nurse acknowledged, "I like to think that teaching goes beyond just that moment. … Everything that you say to them, they take it home and they tell all their family and friends." Several nurses commented that their role in educating patients' caregivers provides an opportunity to manage parental expectations for antibiotics, including clarifying misunderstandings among caregivers and the community about when antibiotics would and would not be necessary.

Explaining the rationale for and risks of antibiotics

Several nurses highlighted the importance of their role in providing education about appropriate antibiotic use and risks by explaining that they could not rely on the doctors to provide such education. One nurse recalled being told by a patient's parent that "the doctors didn't tell me that" when she was informing them about potential risks of a medication. Specifically, nurses explained that they must ensure that parents understand the treatment plan, and they will teach them about potential adverse drug reactions, risk of medication interactions, expected duration of antibiotic administration, and anticipated issues concerning orally administering antibiotics to children.

The nurses' education to parents may include explaining why certain antibiotics are indicated as well as why an antibiotic may not be indicated. For example, one surgical unit nurse explained that many of her patients' parents "are very surprised [and] uneasy about the fact that their kid is not on antibiotics after surgery [for] appendicitis." She stated that she spends time explaining to them that once the infected appendix has been removed, antibiotics are no longer needed for most cases. An outpatient nurse provided another example from the ambulatory setting, stating, "One of my roles very frequently is education that antibiotics aren't … [needed for] viral illnesses." In addition to explaining why antibiotics are not needed for viral infections, she explains potential consequences of using antibiotics unnecessarily.

Tailoring education

Appreciation of families' existing knowledge was raised as an important consideration when tailoring education to families. While some parents of patients with repeated hospitalizations or infections may have substantial existing knowledge, some may not have much baseline knowledge, and others may have misconceptions about what the educating nurse should address. Nurses provided examples of altering their teaching and the resources they would use based on a family's prior knowledge, literacy, and language.

Reviewing discharge instructions

At the time of discharge, the nurse provides instructions to the patient and/or patient's family. This entails reviewing instructions before the patient leaves the hospital about the dose, frequency, and duration of antibiotics, with specific emphasis on completing the full prescribed course of antibiotics, tips for administering oral medications to young children, specific signs and symptoms to watch for that may indicate adverse reactions, and warning signs that should prompt return to the hospital.

Educating themselves

Nurses gain most of their antibiotic knowledge through informal learning but desire more formal education. Informal learning for nurses includes filling knowledge gaps through reading the drug formulary, reviewing the latest evidence-based practice, and having discussions on rounds. One experienced nurse stated, "If I have never heard of it, I looked it up and I learn. That's how I learned most of my antibiotic knowledge." In each of the focus groups, participants suggested antimicrobial stewardship training during onboarding due to lack of formal training. One nurse noted, "It would be really nice to learn more about it because we give them every day. So it's strange that we haven't had more education or focus on this."

Discussion

Through 12 focus group discussions with pediatric clinical nurses at a large freestanding children's hospital, 90 clinical nurses across a range of pediatric clinical units, settings, and years of clinical experience affirmed the important role that nurses play in antimicrobial stewardship. While many nurses who participated in the focus groups were not initially familiar with the term "antimicrobial stewardship", participants were able to vocalize and explain the public health rationale driving the need for stewardship (overuse of antibiotics leading to antibiotic resistance) and the fundamental principles behind it (avoidance of unnecessary antibiotic use) and their perceived important role.

Through these focus groups we found that clinical nurses in general perceive antibiotic stewardship tasks as part of their nursing role, as shown previously in a survey conducted by Monsees, Popejoy, Jackson, Lee, and Goldman (2018) and through focus groups conducted by Carter et al. (2018). In a qualitative study of nurses and infection preventionists at two academic pediatric and adult hospitals, Carter et al. found that participants had overall positive impression of antibiotic stewardship and agreed that nurses should play a major role in antibiotic stewardship. Our study design differed from that conducted by Carter et al., which provided specific examples of antibiotic stewardship tasks that a nurse would or could perform, and assessed participants' reception of these examples, while our study design was more exploratory and documented the roles that nurses express that they already play in antibiotic stewardship. Nevertheless, our findings were consistent with those found by Carter et al. in that nurses identified IV to

oral antibiotic transition and prompting of de-escalation of antibiotics as two important areas for their contribution to antibiotic stewardship.

The barriers to effective contribution to antibiotic stewardship identified through our focus groups are in line with those previously identified. Monsees et al. performed a survey of 180 nurses to identify nurses' identified roles and confidence in engaging in antibiotic stewardship activities. The survey identified barriers to practicing good antibiotic stewardship, including lack of knowledge, not following procedures, poor communication between disciplines, and variability in accepted practices (Monsees et al., 2018). In our present study, participants identified these same barriers to practicing good antibiotic stewardship in various practice settings.

Nurses in the present focus group study described advocating for the patient as central to their role in assuring the best outcome for the patient and for reducing medical errors. Aspects that fell under the nurse's perceived role to "advocate" included questioning the plan (including verifying the necessity, advocating discontinuing antibiotics, ensuring the proper route) and recognizing sepsis. Prior literature has described the nurse's role as a patient "advocate" such as helping patients navigate health care systems and acting as a liaison between physicians and patients (Shannon, 2016). Similar to previously published findings (Greiner and Knebel, 2003), both cultural and practical barriers impede fulfilling this advocacy role. Nurses described the ideal setting to promote speaking up and questioning the antibiotics plan for a patient to be one in which a nurse and a physician have a comfortable and established working relationship, the nurse has confidence in his or her recommendations, the nurse is present during multidisciplinary rounds, a pharmacist is not present on rounds, and the nurse's recommendation is of at least moderate significance. Deviations from this ideal setting would diminish the likelihood of a nurse speaking up. These identified barriers varied across different settings, field of specialty, and level of experience. For example, in the ICU and hematology/oncology unit, nurses relayed feeling greater comfort with questioning the plan for antibiotics than nurses on the general pediatric ward floors.

These declarations are consistent with prior studies addressing barriers to speaking up about patient safety concerns, which have identified fear of negative feedback, fear of being wrong, and fear of no change or retaliation as factors contributing to not speaking up about patient safety concerns (Etchegaray, Ottosen, Dancsak, & Thomas, 2017). This finding suggests that education to nurses should highlight the harm associated with unnecessary antibiotic use, including adverse drug events, *C. difficile* infections, and the risk of subsequent infections with antibiotic-resistant organisms. Each day of unnecessary antibiotic use places a patient at increased risk of harm. Equating unnecessary antibiotic use as potential harm to a patient elevates its importance to that of a patient safety issue, making it more likely for a nurse to speak up to question unnecessary use. Furthermore, nurses indicated greater confidence and willingness to speak up about potentially inappropriate antibiotic use when there were clear institutional guidelines or protocols that they could refer to if they noted a deviation from that protocol. Standardizing care with use of institutional guidelines has been shown to improve quality of care and clinical outcomes of patients (Lion et al., 2016), and including nurses in the development and dissemination of these guidelines would enhance their implementation.

Nurses identified facilitating communication between team members as a key component of their role in antibiotic stewardship. Miscommunication and lack of communication between members of the health care team lead to medical errors (Greiner and Knebel, 2003). Health care services have increasingly recognized that each unit of the health care team works in a "silo" and that enhancing communication requires eliminating these silos (Greiner and Knebel, 2003). The Institute of Medicine and the ANA called on nurses, who are well positioned to coordinate care, to lead the culture change toward better interprofessional collaboration (Institute of Medicine, 2011). Focus group participants shared stories exemplifying nurses facilitating communication between members of the health care team, identifying this as key to the nurse's role.

Nurses identified educating their patients and/or patients' families as integral to their role as a nurse. They felt solely responsible for this important task, citing examples of physicians not providing information about prescribed antibiotics to their patients. Nurses have been consistently ranked as the most ethical profession by a recent Gallup (2017) poll, above physicians and all other health care professionals. Nurses expressed comfort with this task falling in their role and cited specific measures to tailor and adapt their educational efforts to overcome barriers for maximum effectiveness.

Conclusion

This study used focus group methodology to identify key themes associated with the nurse's role in antimicrobial stewardship. Even when pediatric nurses were initially unfamiliar with the term "antimicrobial stewardship," the focused questions enabled them to easily identify numerous daily nursing tasks that fit within the framework of antimicrobial stewardship. Discussing stewardship and its importance with nurses regularly and highlighting the harm associated with unnecessary or inappropriate antibiotic use may elevate the importance of these tasks in the context of a nurse's daily workflow. Having clear institutional guidelines with a standardized approach for antibiotic use that nurses are familiar with would further empower nurses to ensure adherence to protocols. Engaging nurses in antimicrobial stewardship programs at all levels, including committee representation, interdisciplinary rounds, and interprofessional education, as recommended by the CDC and ANA (American Nurses Association, 2017), could improve the existing structure of antibiotic stewardship programs by breaking down the identified barriers to nurses fulfilling their role and further enhance the implementation of antibiotic stewardship activities. Finally, the richness of the data gathered through this study and the derived themes have created a blueprint for the development of an education curriculum that can be implemented to ensure that all clinical nurses receive a standardized education regarding antimicrobial stewardship aligned with their perceived roles and responsibilities.

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Declaration of Competing Interest

The authors have no conflicts of interest to disclose.

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