

A Qualitative Study of the Real-world Experiences of Infectious Diseases Fellows Regarding Antibiotic Stewardship

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Background. Antibiotic-resistant bacterial infections are a major threat to public health, yet improper use of antibiotics remains high. Infectious Diseases (ID) fellows play a major role in antibiotic stewardship efforts, but there is little research on how they view stewardship activities. We performed a qualitative study to explore ID fellows' experiences and perspectives regarding their antibiotic stewardship training and their role as future antibiotic stewards.

Methods. We conducted 17 in-depth interviews with ID fellows across the country. The interviews were transcribed verbatim by the study team, and we used grounded theory to generate themes from these interviews

Results. Fellows focused on concrete tasks of stewardship such as performing antibiotic approvals, didactic and case-based education, and interactions with other physicians and pharmacists. There was little focus on the broader public health relevance of antibiotic stewardship. Pharmacists, not ID physician leaders, were identified as fellows' primary resource for antibiotic teaching. Several fellows suggested that stewardship programs should be led by pharmacists.

Conclusions. ID fellowship training is not successfully conveying the public health importance of antibiotic stewardship or the role of ID physicians as leaders of antibiotic stewardship programs. Fellows are more focused on concrete tasks related to stewardship. ID training programs and societies should consider developing robust curricula involving fellows in the operation of the stewardship program itself, not solely in antibiotic approvals, emphasizing aspects of the program such as complex problem solving that fellows find most compelling, and emphasizing the important role these programs serve in improving public health.

Keywords. Antibiotic stewardship; qualitative interview; fellowship education.

The increased prevalence of antibiotic-resistant (ABR) bacterial infections is a growing problem. ABR infections are more difficult to cure than infections caused by antibiotic-susceptible bacteria, result in increased morbidity and mortality, and impose burdensome costs upon the health care system [1–3]. The Centers for Disease Control and Prevention (CDC) estimates that at least 2 million individuals were infected with antibiotic-resistant bacteria in 2013, with 23 000 deaths attributable to those infections [4].

Antibiotic use is the main driver of antibiotic-resistant bacteria. Despite wide dissemination and awareness of treatment guidelines, inappropriate prescribing of antibiotics remains common [5]. Antibiotics are prescribed unnecessarily in

30%–50% of cases [6]. Programs devoted to improving antibiotic use are known as antibiotic stewardship programs (ASPs). ASPs have been shown to improve prescribing, an important public health goal [7].

The responsibility for leading ASPs and promoting proper antibiotic use in hospitals often rests with the Division of Infectious Diseases (ID). In academic medical centers, many of the responsibilities for antibiotic stewardship are tasked to ID fellows. The way in which the fellow views his/her antibiotic stewardship education and activities may impact how the fellow views stewardship overall and whether leading an ASP is a future career goal. Yet there are no published qualitative studies of ID fellows' experiences of stewardship. To this end, we conducted a qualitative study with the objective of better understanding ID fellows' perceptions of their role as antibiotic stewards in the face of the growing public health threat of ABR infections.

METHODS

Instrument Development

Review of the literature and prior work on the subject [8] informed the creation of a semistructured qualitative interview guide (see the semistructured qualitative interview guide in the [Supplementary Data](#)). The guide included questions aimed at

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understanding the knowledge and attitudes of fellows toward antibiotic stewardship and exploring how the fellowship promoted stewardship education, training, and implementation. The interview guide was pilot-tested with a second-year ID fellow. Following pilot-testing, the guide was updated to include new questions generated from the pilot interview, the structure was re-organized for better flow, and several questions were rewritten to improve clarity. The Boston University Medical Center Institutional Review Board (IRB) approved the research.

Recruitment and Data Collection

Fellows were recruited nationally through e-mail. One of the study investigators (T.F.B.), the director of the ID fellowship at Boston Medical Center, sent information regarding the study to ID fellowship program directors across the country and asked them to forward the information to their respective fellows (Supplementary Figure 1), although we were not able to ascertain what portion did this. Any fellows interested in participating in an interview were directed to e-mail the study interviewer (J.R.M.). The only criteria for inclusion were that the individual was a current ID fellow and that another fellow from the same state had not already been interviewed.

Fellows who agreed to participate scheduled a time at their convenience for an audio-recorded telephone interview. Interviews took place between December 2014 and June 2015. Fellows were given a description of the study before the interview and assured that their participation would be kept confidential. To further protect confidentiality, the IRB granted a waiver of written documentation of consent, and no identifying information was solicited during the recording. Interviews lasted a mean of 37 minutes, with a range of 28 to 50 minutes. To obtain a national perspective, we used iterative sampling, soliciting an interview from a different fellow from a different state until reaching saturation, where no new information or themes emerged from the data [9, 10]. Saturation occurred after 17 interviews. Each fellow was compensated with a \$50 gift card for his or her time.

Data Analysis

The audio-recorded interviews were transcribed verbatim. After each interview was transcribed, the transcription was checked for accuracy by the interviewer. The transcripts were then imported into NVivo, version 11, for coding and analysis. The principles of grounded theory were used to analyze the data [10]. To generate themes from the data, 2 members of the study team (J.R.M., M.L.D.) independently reviewed the initial 2 transcripts to identify emergent concepts related to antibiotic stewardship. The transcripts were reviewed line by line to describe important quotations and passages as codes. Through this process of refining existing categories, the resulting consensus codes better reflected the data. This yielded a comprehensive codebook containing all codes and definitions that was used to code all subsequent transcripts.

RESULTS

We interviewed a total of 17 ID fellows from 17 states across the United States (Supplementary Figure 2). The characteristics of the final sample are described in Table 1. Most fellows were male, white, and in their second year of training. The results of the analysis are presented in 3 distinct thematic categories that further our understanding of how ID fellows view the stewardship role: (1) fellows' views of antibiotic stewardship as a set of discrete, concrete tasks, (2) fellows' views of different provider roles in stewardship, and (3) fellows' suggestions as to what would improve the antibiotic stewardship training in their fellowship program.

Fellows' Views of Antibiotic Stewardship as a Set of Discrete, Concrete Tasks

When asked about the role that stewardship played in the larger context of the fellowship program and in their future career development, fellows spoke about the discrete components of the role and answered with a list of specific tasks associated with stewardship responsibilities such as carrying the antibiotic approval pagers. They also discussed their role in providing antibiotic recommendations and tactics to de-escalate antibiotic use during consultations. Fellows did not refer to stewardship in prevention or public health terms. The most common responses centered on the frustrations and burden of having to carry the antibiotic pager and respond to pages at all hours of the night. In contrast, fellows enjoyed antibiotic discussions in the context of formal patient consultations where antibiotic recommendations were a frequent component. Fellows noted that antibiotic discussions as part of formal consultation, unlike those related to the antibiotic pager, were collaborative with the consulting physician(s), and fellows were able to educate other providers as they worked together to provide the best clinical care. They particularly preferred consults they considered "highly cerebral"

Table 1. Characteristics of Infectious Disease Fellows

Gender	No.	%
Male	12	71
Female	5	29
Race/ethnicity		
White	11	65
Hispanic	2	12
Asian	4	24
Region		
Northeast	4	24
Midwest	4	24
South	5	29
West	4	24
Year in fellowship		
1	4	24
2	11	65
3	2	12

(Fellows 3, 4, 10) that involved complex problem-solving skills to those that were described as routine antibiotic management.

When describing the importance of stewardship, it was also viewed as very individual and patient-specific, rather than as part of a larger public health goal. For example, 1 fellow observed that often his role is simply to “provide reassurance... in not treating something that they think may be an infection but actually isn’t” (Fellow 5). When speaking of their future careers in ID, fellows’ descriptions similarly had a narrow focus, such as needing to be “able to more accurately prescribe the best antibiotic (Fellow 4).” Although 1 fellow mentioned that additional formal ASP education may be beneficial for the broader hospital community (Fellow 3), this was in the context of reducing the number of antibiotic pages and did not appear to be related to a concern for public health.

Fellows’ Views of Different Provider Roles in Stewardship

When describing stewardship activities, all fellows spoke a great deal about their interactions with other clinical staff. Largely absent from fellows’ discussions of other providers was any discussion of the importance of the ID physician ASP leader or other ID faculty member in stewardship directly and in mentoring them as future stewards. In fact, 1 fellow commented that a strength of his program was that they didn’t “need to specifically have the attendings” because the fellows were able to handle the stewardship program, noting that attendings often did not have the “time or willingness to teach” (Fellow 8). ID physicians were most discussed when fellows needed approval of an attending to release a particular antibiotic (Fellows 2, 3, 9). These fellows described the stewardship leadership and mentoring role as being primarily performed by pharmacists. When asked if he felt prepared for the stewardship responsibilities he faced during his first year of fellowship, 1 fellow responded:

Oh no, that’s why we had our trusty pharmacist. I owe her a lot of what I know now. She would tell me, “Yeah, you gotta call them and ask them this way”.... I’ve been learning from her a lot, so without her it would be really, really, really tough. So yeah, we will always have the pharmacist. (Fellow 8)

There was widespread sentiment that the pharmacist was a knowledgeable source that could help fellows answer complex questions around antibiotic choice, dosing, and duration. Fellows spoke about how programs that did not have a fellow carry an antibiotic pager for release of restricted antibiotics often used pharmacists in what the fellows described as the stewardship role. In fact, some fellows suggested that much of the stewardship role could be taken on by pharmacists instead of ID physicians (Fellows 4, 12, 17), whereas no one specifically mentioned the benefit of ID physician ASP leadership. For example, 1 fellow suggested that a program run by nurse practitioners or pharmacists would have advantages, and he

portrayed ID attending involvement as potentially biased or disinterested:

It’s having other people that work with patients have a say, like pharmacists, nurses. I really like that model. And having...an independent group...not biased in terms of making antibiotic choices. I think more of that would be better than sort of the model where you just call the ID attending or the ID fellow and request an antibiotic, where we’re thinking you just want to get it approved and you think of it as a formality. (Fellow 17)

Although some fellows mentioned that their attendings were available to contact (usually for an approval; Fellows 7, 10, 11), there was little discussion of ID physicians as a positive source of antibiotic and stewardship information compared with pharmacists.

Fellows’ Suggestions as to What Would Improve the Antibiotic Stewardship Training in their Program

When asked for feedback about their stewardship experience in fellowship, several fellows expressed that although there was nothing explicit they would change in their program, they believed sharing their experiences could add to the discussion around the best way to conduct stewardship, and some cited the opportunity to share their experiences as the motivating factor in their decision to participate in the interview. For those with suggestions for change, 2 areas for improvement were identified: relieving the burden of carrying an antibiotic pager to approve restricted antibiotics and enhancing formal educational opportunities.

For those who had to carry an antibiotic approval pager, this pager was the primary source of burden in their daily routine and also the aspect they wanted to see changed. One fellow explained his main suggestion was to have a dedicated pharmacy team to deal with the antibiotic restriction program rather than relegating that to fellows.

Fellows recognized the benefit of formal stewardship education but felt that their programs often were not committed enough to the educational aspects of stewardship training. There was some recognition of the benefits of stewardship and a desire to be more involved with the ASP activities. This interface with the hospital stewardship committee was suggested as beneficial not only to the fellow, but to the entire hospital community. Additionally, very few fellows knew how antibiotics were selected to be restricted. Often they knew of the committee that decided such things, but were unaware of the inner workings (Fellows 3, 5).

DISCUSSION

This article responds to recent calls in the literature for qualitative research to better understand antibiotic stewardship [1]. The perspective of the ID fellow has not been previously

explored through qualitative interviews, and our study provides greater understanding of how they view and promote stewardship [11]. We found that ID fellows do not think of stewardship in terms of a broader public health benefit and do not clearly view stewardship activities as best led by ID physicians. Nor do they appear to look to the physician ASP directors or other ID faculty for antibiotic and stewardship teaching. Rather, they highly praise the ASP pharmacist as an invaluable resource, and several fellows believed that ASPs should be pharmacy-based programs. These results should be worrisome for ID physicians and their professional societies and for program directors.

The Infectious Diseases Society of America has sought to document and emphasize the importance of ID physician involvement as a way to improve patient outcomes [12]. The value of ID physician leadership for ASPs has been a particular focus. The Infectious Diseases Society of America and the Society for Healthcare Epidemiology note the importance of both physician and pharmacist direction in the 2016 ASP implementation guideline [13]. Spellberg et al. recently published guidance for making the business case for implementing an ASP to hospital administrators [14], strongly advocating physician leadership. However, a survey by the CDC looking at implementation of the core elements of ASPs at hospitals demonstrated that the primary ASP leader was more likely to be a pharmacist (37%) than a physician (30%) [15]. Our findings suggest that the message about the physician's role in antibiotic stewardship is not being properly communicated to ID fellows and that they are not being educated to be ASP leaders.

Our results also have implications beyond ID for the increasing reliance on electronic forms of clinical management. We found that many trainees did not seem to understand the importance of their role in prescribing, instead seeing it as a mundane task that could be guided by electronic ordering systems or offloaded to a more efficient pharmacy model to take care of dosing, drug interactions, and other aspects of the prescribing decision. Although computerized provider order entry (CPOE) has been shown to reduce errors caused by misreading handwriting and providing useful on-demand information such as alerting providers to potential medication interactions, it can create a system of workarounds that values speed (getting through the CPOE quickly) over thorough medical decision-making [16]. We see this in electronic health records as well, where copying and pasting notes saves time but creates potential risks for patients [17]. As other areas of clinical practice increasingly rely on electronic interventions (such as electronic pop-ups reminding providers of recommended tests or alerting them to possible medication interactions), our findings in the context of stewardship offer important insights to the unintended consequences of outsourcing clinical decision-making.

The lack of robust education about antibiotics and stewardship begins in medical school. In contrast to most pharmacy schools, which offer a semester-long course in infectious

disease treatments [18], medical schools include only a few lectures about antibiotics within a broader course covering pharmacology. In a study by Abbo et al., medical students were surveyed about antibiotic prescribing and education. Ninety percent stated that they wanted more education on appropriate use of antibiotics. Their mean antibiotic knowledge score was only 51% but varied significantly between the 3 schools surveyed, and only 15% had completed a clinical ID rotation [19]. In residency, young physicians receive limited antibiotic and stewardship education as well. In 1 report, although the residents knew that broad-spectrum antibiotics can cause adverse events, they did not connect those adverse events with increased patient morbidity or mortality and used those agents frequently [20]. We have shown that even in ID fellowship training, teaching about antibiotics and stewardship is not a priority. When asked about stewardship overall, fellows frequently interpreted stewardship to mean antibiotic restriction programs and responding to requests for antibiotics. Fellows rarely discussed the societal importance of stewardship and the crisis of increasing prevalence of multidrug-resistant bacterial infections.

Based on our findings, we have 3 recommendations. First, fellowship programs may benefit from leveraging the aspects of the program that fellows found the most valuable—highly cerebral complex problem-solving and working with other physicians to provide the best possible clinical care and promote antibiotic stewardship. Ways to minimize the burden of the antibiotic approval pager and maximize the educational benefit should be sought, and future research should assess the burden of the fellowship workload overall; it is possible that the complaints we heard regarding the antibiotic pager are symptomatic of feeling overwhelmed in general. Antibiotic approvals should be framed as educational tasks, and review of approvals with ASP directors as learning opportunities.

Next, fellows appear receptive to more formal education about antibiotics and stewardship; a robust curriculum should be instituted. Organizations such as the Society for Infectious Disease Pharmacists [21] and MAD-ID [22] have developed intensive curricula and certification by their organizations. Although physician societies are currently developing similar programs, they have not yet been implemented. Physicians have greater clinical training than pharmacists but do not receive the intensive instruction about each antibiotic's mechanisms of action and resistance pharmacokinetics, spectrum, and dosing that pharmacists do. To best complement each other, physicians need to be confident in their antibiotic fund of knowledge. A curriculum can also teach trainees to understand the broader value of stewardship and demonstrate that stewardship isn't just a series of concrete and sometimes tedious tasks but rather an effort to preserve the efficacy of antibiotics, reduce the emergence of antibiotic-resistant bacterial infections, and provide an important public health benefit.

Finally, programs should encourage fellow engagement by including fellows as team members of the antibiotic stewardship team. Fellows often do not know how certain stewardship decisions were made, such as restrictions of certain antibiotics. Inclusion of fellows in ASP activities and meetings can help them understand the motivations for stewardship policies. Listening to and respecting their ideas could promote better stewardship education if fellows are invested in the success of their proposed changes. Some institutions have embraced new training strategies that enhance trainee engagement with educators to promote career aspirations and research dissemination [23]. This approach can be used for stewardship. ID physician ASP leaders can be role models for fellows considering their career options. We found that fellows often relied on the expertise of pharmacists and saw them as interchangeable (or more useful) than ID physicians. ID faculty should be ready to discuss antibiotic usage and defend their choices with evidence from the literature so fellows can learn to appreciate them as an important educational resource in this area. An emerging literature suggests that the success of ASPs is determined, in part, by managing interprofessional relationships, rather than focusing only on advice-giving [24], supporting the engagement of fellows in the hospital-wide antibiotic stewardship team.

This study has several limitations. First, as with any qualitative study, the results are not meant to be generalizable; instead they represent an in-depth exploration of the attitudes and beliefs of the study sample. Second, because we interviewed fellows, we only learned about the stewardship experience at an academic medical center. Stewardship programs at nonteaching institutions are likely different, and we were unable to explore those differences in our interviews. Third, although participants were assured of confidentiality and their responses appeared to be very candid, we cannot exclude the possibility of biased or socially desirable responses. Fourth, we do not know why these fellows chose to participate. If they specifically wanted to complain about antibiotic approvals, for example, it could have biased the sample. This was likely not the only reason every fellow had for participating, and through qualitative methods, we reached saturation of the themes and hopefully a good representation of attitudes. Fifth, we depended on ID fellowship program directors to forward our interview request to fellows. We do not know how many program directors did this, and some fellows may have been unaware of the interview opportunity. Finally, we did not collect information on which programs had a formal ASP educational component or track within the fellowship. Thus, we do not know if fellows advocating for more education were in programs that had instituted formal ASP training or those programs that had not. Future research would benefit from exploring the effectiveness of incorporating robust ASP educational components into ID fellowship. Despite those limitations, this in-depth analysis has raised important issues

that would be high priority for ID physicians to address, and further research is warranted.

Our findings contribute to a more comprehensive understanding of the attitudes and beliefs of ID fellows regarding antibiotic stewardship. The insights from this study can inform future research and educational interventions to better train the stewards of tomorrow and reinforce the important role ID physicians play in implementing and leading ASPs.

Supplementary Data

Supplementary materials are available at *Open Forum Infectious Diseases* online. Consisting of data provided by the authors to benefit the reader, the posted materials are not copyedited and are the sole responsibility of the authors, so questions or comments should be addressed to the corresponding author.

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