Spring 2017

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APA Citation

Laake, A., Bernabe, G., Peterson, J., & Liappis, A. (2017). Internal Medicine Resident Perspectives Regarding Broad-Spectrum Antibiotic Usage.. *Open Forum Infectious Diseases, 4* (2). http://dx.doi.org/10.1093/ofid/ofx060

Open Forum Infectious Diseases

BRIEF REPORT

Internal Medicine Resident Perspectives Regarding Broad-Spectrum Antibiotic Usage

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Focus groups held with internal medicine residents discussed their perspectives regarding broad-spectrum antibiotic (BSA) usage. Residents knew of BSA-associated adverse events, but they did not associate such events with increased patient morbidity and mortality, and they were more likely to use BSA in situations with diagnostic uncertainty and sick patients.

Keywords. antimicrobial stewardship; broad-spectrum antibiotic usage; qualitative research; resident education.

Prescribing antibiotics is a complex behavior influenced by national and local culture and individual behavior patterns [1]. Qualitative research has explored these influences [2]. Understanding influences affecting initiation of broad-spectrum antibiotic (BSA) coverage is crucial in developing effective antimicrobial stewardship programs.

In academic training centers in the United States, internal medicine residents (IMRs) supervised by attending physicians typically prescribe antibiotics. The American College of Graduate Medical Education (ACGME) has implemented the "Milestone" program, a competency-based system requiring IMRs to manage "patients with progressive responsibility and independence" [3].

This system makes IMRs ideal targets for stewardship interventions because they are responsible for most antibiotic prescriptions while also forming prescribing habits. An estimated 37% of such prescriptions are inappropriate; optimizing them could decrease rates of *Clostridium difficile* infection (CDI) and mitigate selective pressure contributing to antimicrobial resistance [4–6]. Utilizing qualitative methodology, we examined motivations for prescribing empiric coverage and perceptions regarding BSA usage in IMRs in a US hospital.

Received 15 November 2016; editorial decision 23 March 2017; accepted 2 April 2017.
Presented in part: IDWeek 2013, San Francisco, California.
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Open Forum Infectious Diseases®
Published by Oxford University Press on behalf of Infectious Diseases Society of America 2017.

DOI: 10.1093/ofid/ofx060

METHODS

Setting and Subjects

The study occurred between February and September 2013 at the Washington, DC Veterans Affairs Medical Center (DCVAMC), an urban 180-bed tertiary care teaching hospital. Participants were selected from IMRs in postgraduate years (PGYs) 1–3, working on general medicine or elective rotations from 4 academic residency programs (ARPs) affiliated with the DCVAMC. The Medical Service Office provided lists of all IMRs meeting the selection criteria. Study participant IMRs consented knowing that their responses would be recorded anonymously and transcribed pseudonymously. Approvals from the DCVAMC Institutional Review Board and Research and Development Committee were obtained before beginning the study. Internal Medicine Program Directors from each affiliated ARP also approved its program's IMRs' participation. The DCVAMC had no antimicrobial stewardship program during the focus groups but has subsequently developed one.

Qualitative Methodology

Seven semistructured focus group sessions were conducted. Data saturation was achieved by the sixth focus group session. Focus groups were chosen over individual interviews due to scheduling, efficiency, and convenience for both participants and researchers. Weekly focus group sessions contained 10 to 12 IMRs and met for 2 discussions at the DCVAMC. An Infectious Disease fellow (A.M.L.) moderated each discussion. A fellow was selected to moderate (1) because of knowledge and language considerations required to guide the discussions and (2) for the comfort of the participants in discussing topics with a peer.

Focus group sessions comprised IMR participants and the moderator engaging in a semistructured (Supplementary Data) question-and-answer period followed by a clinical vignette-guided discussion. Sessions were recorded on an audio-MP3 player. Recordings were then transcribed into Microsoft Word, and transcription data was imported into Atlas TI, a qualitative research analysis program (Atlas TI 2014, Berlin).

Quantitative Data

Demographic data, including PGYs, genders, and ARP enrollments, were collected for all IMRs at each focus group session. The researchers conducted all analyses with χ^2, 2-tailed tests, accepting a P value of <.05 (SPSS, version 21; SPSS Inc., Chicago, IL).

Qualitative Analysis

Three researchers (A.M.L., G.B., and J.P.) first reviewed the initial transcripts together and developed codes through

consensus. Codes were then applied to the transcripts by each researcher individually. Next, researchers met collectively to compare individual coding applications and achieve group consensus. Finally, a content analysis of the group's consensus codes was used to develop emergent-specific themes (Table 1). The frequency of responses represent unique responses given by individual study participants to which researchers applied that code over the course of the recorded sessions.

RESULTS

Forty-eight IMRs participated over the 8-month study period; no IMRs declined to participate in the focus groups. Sixty percent of the participants were PGY-1, 17% were PGY-2, and 23% were PGY-3 IMRs. Fifty-four percent of participants were female. Researchers found no difference in the frequency with which specific codes were identified among the 4 ARPs (data not shown). The PGY-2 participants contributed proportionally more comments than participants from other years (PGY-2: 11 quotes per IMR; PGY-3: 8 quotes per IMR; PGY-1: 5 quotes per IMR; $P < .0001$); however, researchers found no difference in the frequency with which specific codes were identified among the different years.

Themes Identified From Focus Group Participant Analysis

Theme 1: Factors That Influenced Broad Spectrum Antibiotics Use by Internal Medicine Residents

The IMRs cited many different influences in their responses (64 responses) related to decisions about BSA usage, including epidemiological risk factors for resistant bacteria, appeasement of patients and attending physicians, fear of liability, and even convenience. However, the 2 most commonly mentioned influences were diagnostic uncertainty (22 responses) and fear regarding how "sick" the IMR perceived the patient to be (22 responses).

Theme 2: Consequences of Antibiotic Spectrum Choice

There were also many responses about the consequences of antibiotic spectrum choice (22 responses). Patient morbidity

Table 1. Themes

Theme	Frequency of Responses	Representative Quotes
Factors that increase broad-spectrum antibiotic (BSA) usage by internal medicine residents (IMRs)	Frequently in responses: Diagnostic uncertainty; patients perceived to be clinically "sick." Infrequently in responses: Epidemiological risk factors; appeasement of attending physician or family members; liability concerns; convenience.	"The less you know about the patient, [the] more inclined you are to want to cover broadly; so, night-float would [cover] if someone became febrile overnight, or becomes toxic, or [if] for whatever reason they are more inclined to start something broader." – Postgraduate Year (PGY)-1 "I mean, I don't consider that guidelines always apply if you don't have a good source." – PGY-2 "So to be honest, I would probably just start [vancomycin] and [piperacillin-tazobactam] because he is, you know, he meets a few [systemic inflammatory response syndrome] criteria, and I don't think there is any reason [to prescribe] too narrowly when they look like they are that sick." – PGY-1 "I mean, one of the reasons we might escalate when we don't need to is, like, the clinical context, like maybe this patient looks sick or something, like, by the book, and the pharmacists I am sure know the guidelines better than we do, [but] it's the clinical context that alters our clinical judgement." – PGY-1
Consequences of antibiotic spectrum choice	Frequently in responses: Consequences for overly narrow coverage frequently included patient morbidity and mortality. Infrequently in responses: Antibiotic resistance as a consequence for both overly broad and overly narrow antibiotic spectrums. *Clostridium difficile* as a consequence of overly broad-spectrum antibiotic use. Never in responses: Patient morbidity and mortality mentioned as a consequence of broad-spectrum antibiotic use.	"Bacteremia, death, it depends… your patient has florid [pyleonephritis], and you are worried they are bacteremic, and you give them [ciprofloxocin], then you may have just killed the person." – PGY-2 "Aside from treatment failure, [the infection] can progress; the patient can become septic and have treatment complications from sepsis…" – PGY-1 "I guess, in theory, it could increase resistance later, and broad spectrums cause more [*Clostridium difficile*] and things like that." – PGY-2
The IMR role in antibiotic prescription	Frequently in responses: IMR writes the initial antibiotic prescription, with little subsequent attending physician intervention. Infrequently in responses: Occasional subsequent attending physician intervention in antibiotic prescription after IMR has written the initial prescription. Never in responses: Attending physician writes initial antibiotic order.	"That would be me as a resident… I am usually doing more of the admitting because I am overnight, and I usually choose the empiric antibiotic coverage, and my attending [physician], I am usually able to justify my choice to my attending [physician], most of the time my attending [physician] does not switch it." – PGY-2 "I think it always gets run by the resident before it gets written; it doesn't always get run by the attending [physician] before it gets written." – PGY-2

and mortality was discussed in the responses, but this was associated exclusively with choosing too narrow of an antibiotic spectrum (8 responses). The IMRs connected the immediate consequences of inappropriately narrow-spectrum antibiotic use and inadequate coverage of a patient's causative bacterial organism with progressive infection, and they identified clinical decompensation and mortality as ultimate outcomes. However, although IMRs identified the immediate consequences of unnecessarily BSA use, including CDIs and increased risk of antibiotic-resistant infections in the future, they did not connect such adverse events with increased morbidity or mortality in their patients.

Theme 3: The Role of Internal Medicine Residents in Inpatient Antibiotic Prescription

The IMRs consistently reported responsibility for making initial decisions regarding both which antibiotics to use and when to begin antibiotic treatment for hospitalized patients. In their responses (20 responses), none indicated that attending physicians wrote initial prescriptions more frequently than IMRs. Furthermore, the majority of their responses indicated that they believed their attending physicians rarely changed their initial antibiotic prescriptions.

DISCUSSION

Qualitative methods were used to examine the decision-making framework for inpatient BSA usage among US medical trainees. In their risk assessment of antibiotic spectrum decisions, IMRs associated prescribing an overly narrow antibiotic spectrum with clinical morbidity and mortality. Although they correctly identified increased antimicrobial resistance and CDIs as potential consequences of overly broad antibiotic spectrum usage, they did not correlate those consequences with morbidity and mortality. It is possible that IMRs independently understand that multidrug-resistant organisms or CDIs lead to significant patient morbidity and mortality; such knowledge was not assessed in our focus groups. Regardless, they do not appear to make the transitive jump from unnecessary BSA usage to increased patient morbidity and mortality via antimicrobial resistance and CDI. Antimicrobial stewardship programs should comprehensively educate IMRs on the risks of antibiotic use and encourage them to consider the risks of increased antimicrobial resistance and CDI when prescribing BSAs. The Centers for Disease Control and Prevention has invested resources into highlighting the dangers of antimicrobial resistance and its negative consequences, both to physicians and to patients directly (via the 2013 Report on Antimicrobial Resistance and the ongoing "Get Smart" campaign, respectively) [7, 8]. At an institutional level, attending physicians should highlight cases of antimicrobial resistance and CDIs, along with the antibiotic histories of the patients so affected. Trainees should be made aware of the antibiotic usage rates of their institution and its rates of antimicrobial resistance and CDI, and they should also be encouraged to regularly re-evaluate the risks and benefits of ongoing antibiotic treatment.

Regarding other findings, participants perceived that their attending physicians changed their initial antibiotic choices infrequently, making the IMRs the primary decision makers on their teams' antibiotic usage. Such perceptions are consistent with the ACGME—Residency Review Committee—Internal Medicine Guidelines, which state that "[a]s residents gain experience and demonstrate growth in their ability to care for patients, they assume roles that permit them to exercise those skills with greater independence" [3]. However, these perceptions are at odds with qualitative research from the United Kingdom and other European countries, in which junior-level physicians did not believe their opinions had an effect on final antibiotic prescriptions [9].

Participants were more likely to prefer BSAs in situations containing diagnostic uncertainty; similar findings have been noted for outpatient antibiotic prescriptions [10, 11]. They were also more likely to recommend BSAs in situations in which the patient appeared to be clinically unstable or perceived as "sick", consistent with results of previous qualitative studies [6].

Strengths of this study include it (1) highlighting differences between US and non-US training systems and (2) being one of the first studies to gather qualitative data on antibiotic usage from US IMRs. Weaknesses include (1) uncertainty regarding how participants' perceptions on inpatient antibiotic prescription relate to their antibiotic prescription habits in clinical settings and (2) lack of input from their attending physicians.

CONCLUSIONS

In conclusion, there is a dual opportunity for antimicrobial stewardship programs targeting trainees. Educators can provide IMRs with a comprehensive understanding of risks associated with antibiotic usage to influence their nascent prescription habits, while also affecting current prescription rates.

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.

Acknowledgments

Disclaimer. The views expressed in this article are those of the authors and do not necessarily reflect the policies of the Department of Veterans Affairs.

Potential conflicts of interest. All authors: No reported conflicts of interest. All authors have submitted the ICMJE Form for Disclosure of Potential Conflicts of Interest. Conflicts that the editors consider relevant to the content of the manuscript have been disclosed.

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