

ORIGINAL ARTICLE

Multisite Exploration of Clinical Decision Making for Antibiotic Use by Emergency Medicine Providers Using Quantitative and Qualitative Methods

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OBJECTIVES. To explore current practices and decision making regarding antimicrobial prescribing among emergency department (ED) clinical providers.

METHODS. We conducted a survey of ED providers recruited from 8 sites in 3 cities. Using purposeful sampling, we then recruited 21 providers for in-depth interviews. Additionally, we observed 10 patient-provider interactions at one of the ED sites. SAS 9.3 was used for descriptive and predictive statistics. Interviews were audio recorded, transcribed, and analyzed using a thematic, constructivist approach with consensus coding using NVivo 10.0. Field and interview notes collected during the observational study were aligned with themes identified through individual interviews.

RESULTS. Of 150 survey respondents, 76% agreed or strongly agreed that antibiotics are overused in the ED, while half believed they personally did not overprescribe. Eighty-nine percent used a smartphone or tablet in the ED for antibiotic prescribing decisions. Several significant differences were found between attending and resident physicians. Interview analysis identified 42 codes aggregated into the following themes: (1) resource and environmental factors that affect care; (2) access to and quality of care received outside of the ED consult; (3) patient-provider relationships; (4) clinical inertia; and (5) local knowledge generation. The observational study revealed limited patient understanding of antibiotic use. Providers relied heavily upon diagnostics and provided limited education to patients. Most patients denied a priori expectations of being prescribed antibiotics.

CONCLUSIONS. Patient, provider, and healthcare system factors should be considered when designing interventions to improve antimicrobial stewardship in the ED setting.

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Antibiotic-resistant bacteria, such as methicillin-resistant *Staphylococcus aureus* (MRSA) and extended spectrum β -lactamase-producing organisms (ESBLs), have emerged and expanded their presence from healthcare settings to the community, leading to increased mortality, morbidity, and rising healthcare costs.^{1,2} Inappropriate antimicrobial use has been described as the most important preventable cause of drug resistance in both hospital and community settings.³⁻⁶ Antimicrobial stewardship, or the organized optimization of antibiotic utilization, has been demonstrated to reduce unnecessary antibiotic use. At least 15% of ED visits result in

antibiotic use,⁷ with poor compliance to evidence-based guidelines^{8,9} and overuse of broad-spectrum antibiotics.^{10,11} Despite the important role of the ED in antimicrobial prescribing, it remains a largely untapped setting for antimicrobial stewardship interventions, with no studies to date on barriers to practice change. To address this gap, a mixed-method approach was chosen to examine provider, patient, and environmental factors associated with antimicrobial prescribing in the ED. This approach is optimal for an understudied phenomenon, as it allows for an exploratory approach and data triangulation.¹²

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A. Demographic information, training, & experience
<i>What additional training or expertise in infectious diseases or antibiotic use, if any, do you think might affect your knowledge and perceptions on antibiotic prescribing in the ED?</i>
B. Individual provider's empiric antibiotic prescribing practice
<i>In this first section, I will ask you questions about any specific "rules of thumb" that you employ in making your decisions regarding antibiotic prescriptions in patients with uncomplicated infections in the ED. First, limiting discussion of this section to clinical features and indicators;</i>
B1.
<ul style="list-style-type: none"> • <i>What is your experience with evidence based guideline recommendations for antibiotic use in patients with suspected infection?</i>
B2.
<ul style="list-style-type: none"> • <i>How do you feel colleagues' or other providers' opinions might factor in decisions to prescribe antibiotics?</i> • <i>How does prior experience with treating patients with similar infections affect your antimicrobial prescribing decisions?</i> • <i>What ED specific factors do you think might affect prescribing practices, compared to office based settings?</i> • <i>How does this differ for making the decision to use an antibiotic compared to antibiotic choice (for example, narrow versus broad spectrum antibiotic?)</i> • <i>Is there anything else that we haven't discussed that influences your antibiotic prescribing practice?</i>
C. Scenarios: Diagnosis and Management of Infections in the ED Setting
<i>Now I am going to ask about diagnostic testing in the ED and how this may influence your antibiotic clinical decision making for various clinical problems.</i>
C1. Urinary Tract Infection:
<ul style="list-style-type: none"> • <i>Suppose you have a previously healthy female with new frequency, urgency, dysuria without flank pain?) (examples: urine dipstick, urinalysis, urine culture) How would you typically diagnose and manage that patient?</i> • <i>What patient or clinical factors would influence you to order diagnostic tests? (example, flank pain, fever, prior UTI)</i> • <i>What non-patient factors influence your ordering tests?</i> • <i>How do test results change your management? (for example, urine dipstick or urinalysis results)</i> • <i>Some EDs routinely order a urine dipstick and hcg on females with lower abdominal pain. What are your thoughts about this practice?</i> • <i>What is your opinion about routine urine cultures?</i> • <i>How do you follow up on cultures? What do you do with discrepant results?</i>
C2. Cutaneous Abscess:
<ul style="list-style-type: none"> • <i>Suppose you have a patient who is a 28 year old previously healthy male with a cutaneous abscess on his extremity with 2 cm in diameter of erythema and no fever that you have decided needs incision and drainage. Which diagnostic tests do you typically use in the ED for patients with cutaneous abscesses?</i> • <i>Describe a clinical vignette where you would prescribe an antibiotic. What patient or clinical factors influence your use of these tests? What is your opinion on wound cultures for patients with abscesses?</i>
D. Exploring barriers and facilitators to antimicrobial use in the ED
D1.
<ul style="list-style-type: none"> • <i>What is your opinion on whether antibiotics are overused in the ED setting? (why?)</i> • <i>For which scenarios do you think antibiotics may be overused in the ED?</i> • <i>Are there situations where you have used a broad spectrum antibiotic when you feel you could have used a narrower spectrum? Tell me about those situations.</i> • <i>Are there any situations where you prescribed an antibiotic you feel could have been avoided? Tell me about those situations.</i>
D2.
<ul style="list-style-type: none"> • <i>What is your understanding of the concept of antimicrobial stewardship? Can you define it for me?</i> • <i>How do you think antimicrobial stewardship applies to the ED setting?</i> • <i>What do you believe the challenges are with reducing unnecessary antibiotic use in the ED?</i> • <i>What are the facilitators?</i>
D3.
<ul style="list-style-type: none"> • <i>What is your opinion on antibiograms?</i>
D4.
<ul style="list-style-type: none"> • <i>What would you find most effective in helping you to make more evidenced based antibiotic prescribing decisions in the ED?</i>
Wrap-Up
<ul style="list-style-type: none"> • <i>Were there any additional thoughts or comments about clinical decision-making for antibiotic use or barriers and facilitators to antimicrobial stewardship in the ED you wanted to share?</i> • <i>Were there any questions you thought I should ask, but did not?</i> • <i>Is there anything else about how you make decisions that you think is relevant?</i>

FIGURE 1. Semistructured interview guide questions. ED, emergency department.

Initial Interview	Post Consultation Interview	Antibiotic Specific Questions
Why have you come to the ED today? What symptoms are you experiencing?	Overall, how do you feel the consultation went? Why do you feel that way?	Have you taken Antibiotics before? a. If so, how many times? Have they worked well in the past? b. If not, is there a particular reason why?
Have you had this illness before? a. If so, how did you treat it? Which treatments helped and which did not? b. If not, are you familiar with what types of treatments are given to someone experiencing your symptoms? What are they?	How well do you feel your physician listened to and understood you?	What is your understanding of why antibiotics sometimes work and other times do not?
Do you have expectations about how you will be treated by you physician or specific treatment options they may provide? If so, what are they?	How did your physician explain your illness to you? Did you understand them?	Are you aware of what might happen if antibiotics are consistently overprescribed? If so, does that concern you?
	Do you agree with the treatment prescribed? Was there any other treatment you wished you had received, but did not?	

FIGURE 2. Emergency department (ED) observational study data collection tool.

METHODS

This study was approved by institutional review boards at the George Washington University, Johns Hopkins University, MedStar Health, and Olive View–University of California Los Angeles Medical Center.

Provider Survey

From September 2012 to July 2013, we conducted a quantitative survey of ED providers recruited from 8 sites in 3 cities including urban tertiary care academic centers, military treatment facilities, a county facility, and a tertiary pediatric center. Some providers also practiced in community settings. Convenience sampling was used; the 8 EDs are sites for research collaborations on infectious diseases. The survey was modified from previous surveys on antimicrobial stewardship^{13,14} and administered via RedCap, a secure web application. Eligible providers (435 attending physicians, residents, and midlevel providers with at least 2 years of ED experience) were invited to participate through electronic mailings and distribution of surveys at faculty and resident conferences. Data were collected using Likert scale and multiple choice format, including demographic characteristics; practice site; types of resources used in the ED when making antibiotic prescribing decisions; and knowledge, attitudes and beliefs regarding antibiotic prescribing.

In-Depth Interviews

We recruited a convenience subset of 21 survey participants to complete in-depth interviews, balancing provider experience, setting, and sex. We selected this number on the basis of available funding for the 20–25 total participants required for qualitative analysis. From November 2012 to June 2013, interviews were conducted in person after verbal informed consent using a semistructured interview guide (Figure 1) by L.M., a board certified emergency physician, and P.A., an emergency medicine resident with 2 years of experience. The interview contained 4 primary questions and 2 clinical scenarios (urinary tract and skin and soft-tissue infection) related to antimicrobial prescribing and lasted 45–60 minutes (Figure 1). Interviews were audio recorded, and de-identified transcriptions were produced by Daily Transcriptions. Interviewees received a \$50 gift card for their participation.

ED Observational Study

From June 2013 to August 2013, we observed 10 patient-provider interactions at 1 ED site, an urban academic center. Observed interactions had a chief complaint of upper respiratory, urinary tract, or skin and soft-tissue infection. Providers had previously completed our in-depth interview. Verbal consent was obtained from patients and providers in person. G.B., a biostatistician, collected data on chief complaint, diagnosis, and antibiotic use and de-identified all

TABLE 1. Survey Descriptive Results

Characteristic	Respondents (<i>n</i> = 150)
Demographic characteristic	
Age, years	
≤30	25
31–40	55
41–50	12
>50	8
Sex	
Female	50
Male	50
Title	
Attending	59
Resident	36
PA/NP	5
Location setting	
Urban tertiary academic centers	52
GW residents; rotate with a community tertiary hospital	19
Urban country hospital	18
UCLA residents; rotate with an urban tertiary academic center	
Military treatment facility	15
Urban academic pediatric center	15
Duration of practice, mean (range), years	8.2 (0.4–37)
Antibiotic use and confidence	
On a typical shift, for what percentage of patients being discharged to home do you prescribe antibiotics?	
<10%	36
10%–20%	51
21%–40%	8
41%–60%	2
>60%	1
Not sure	2
Mobile use	
Currently use a smartphone or tablet	
Yes	89
No	11

NOTE. Data are percentage of survey respondents, unless otherwise indicated. GW, George Washington University; NP, nurse practitioner; PA, physician assistant; UCLA, University of California, Los Angeles.

records in accordance with institutional review board stipulations. All observations were conducted by G.G., a medical anthropologist; notes were taken of the informants' responses and general observations of the ED visit (Figure 2). Six key indicators of antibiotic clinical decision making, as informed by the literature on this topic, were selected and monitored for occurrence: (1) patient explicitly or implicitly asked for antibiotics, (2) provider informed patient whether the infection was viral or bacterial, (3) provider explained which types of infections antibiotics successfully treat, (4) patient asked provider questions about his or her treatment plan, (5) provider gave patient a choice of treatment, and (6) patient asked for treatment during their ED visit that had not yet been provided. Follow-up interviews were conducted at the conclusion of the visit with the participant and the provider to

assess satisfaction with the outcome. As an incentive, patients and providers were offered a \$5 gift card for their participation.

Data Analysis

SAS 9.3 was used for survey analysis. Descriptive frequencies and nonparametric χ^2 tests were performed for quantitative data.

Interviews with providers were audio recorded, transcribed, and coded using a thematic approach based on a constructivist theoretical perspective, which acknowledges the multiple truths and realities of subjectivism and incorporates mutuality between researcher and subjects.¹⁵ We created an initial interview codebook from themes identified in the literature,

TABLE 2. Analysis of Important Factors and Predictors from Quantitative Survey

Important factors and predictors	Attendings, % (n = 88)	Residents, % (n = 54)	P ^a
Antibiotic use and confidence in prescribing			
How confident are you that antibiotics are used optimally in ED patients being discharged from the hospital?			.001
Very confident	30	4	
Somewhat confident	61	81	
Somewhat unconfident	9	13	
Very unconfident	0	2	
How confident are you that antibiotics are used optimally for ED patients being admitted to the hospital?			.48
Very confident	33	26	
Somewhat confident	59	67	
Somewhat unconfident	7	7	
Very unconfident	1	0	
Mobile use/online tool beliefs			
Important sources of information			
ID faculty	14	13	.19
Other ED colleagues	15	32	.001
Internet	21	23	.36
Med letter/journals	8	4	.30
Sanford guide	26	21	.07
EMRA guide	17	44	.002
Smartphone/mobile application	19	30	.31
Hospital pharmacist	12	31	.003
If it was provided to you via smartphone or tablet, how useful would you find an online decision support tool for antibiotic selection in your ED practice?			.001
Extremely useful	44	72	
Somewhat useful	44	26	
Not very useful	5	0	
Not useful at all	2	0	
Do not know	5	2	
If antibiotic recommendations were embedded in the electronic medical record, how useful would you find an online decision support tool for antibiotic selection in your ED practice?			.42
Extremely useful	51	60	
Somewhat useful	40	31	
Not very useful	5	3	
Not useful at all	1	2	
Do not know	3	4	
If it was provided to you via smartphone or tablet, would you use an online decision support tool for antibiotic selection in your ED practice?			.001
Definitely	41	70	
Probably	42	24	
Probably not	16	0	
Definitely not	1	1	
If antibiotic recommendations were embedded in the electronic medical record, would you use an online decision support tool for antibiotic selection in your ED practice?			.95
Definitely	49	52	
Probably	46	41	
Probably not	4	7	
Definitely not	1	0	
Opinion on antibiotic use			
Antibiotics are overused in the ED			<.0001
Strongly agree	31	13	
Agree	56	44	

TABLE 2 (Continued)

Important factors and predictors	Attendings, % (n = 88)	Residents, % (n = 54)	P ^a
Neutral	9	32	
Disagree	4	11	
Strongly disagree	0	0	
Antibiotic resistance does not present a significant problem in the ED at my institution			.21
Strongly agree	1	0	
Agree	2	7	
Neutral	12	7	
Disagree	50	63	
Strongly disagree	35	22	
Antibiotics are overused in non-ED settings at my institution			.02
Strongly agree	34	19	
Agree	40	41	
Neutral	21	30	
Disagree	5	7	
Strongly disagree	0	3	

NOTE. Boldface type indicates statistical significance. ED, emergency department; EMRA, emergency medicine residents association; ID, infectious diseases.

^a Nonparametric χ^2 test.

with modifications made during the analysis phase. Codes were grouped according to the knowledge-attitudes-behaviors model and heuristics and biases in medicine.^{16,17}

Qualitative codes were analyzed thematically across interviews to provide detail on the contribution of various factors to antibiotic decision making. We used a cyclical process of data collection, analysis, and provisional coding, with data collated into subthemes during subsequent analysis. Codes were continually added until coders perceived achievement of theme saturation. After the first 10 interviews, codes were combined on the basis of similarity of meaning and co-occurrence, and they were combined again at the end of 20 interviews. First-level codes were collapsed into second-level codes in a hierarchical fashion. Analysis of the twenty-first interview was used as a validation interview. Interviews were coded jointly by L.M. and G.G., with consensus on analysis and interpretation through continual discussion with and arbitration by P.A. in cases of disagreement. Data analysis was facilitated using NVivo 10.0 software (QSR International).

For the observational study of patient-provider interactions, field and interview notes and frequencies of key indicators of clinical decision making were compiled. We synthesized data for each individual patient and then compared trends and outliers among all informants.

RESULTS

Provider Survey

One hundred and fifty participants (35%) responded, with an even distribution across sex. Of the participants, 59% were attendings, 36% were residents, and 5% were midlevel pro-

viders. The mean number of years in practice for attendings was 16.4 (Table 1). Among the 54 emergency medicine residents, the mean number of years in residency was 2.8. Interns were excluded.

When comparing attending with resident physicians, there were several significant differences (Table 2). Of the physicians who felt “very” or “somewhat” confident that they were using antibiotics optimally in ED patients being discharged home, significantly more attendings (87%) than residents (57%) agreed or strongly agreed that antibiotics are overused in the ED ($P < .0001$). However, only 10% and 14%, respectively, believed that they overprescribed antibiotics. Providers used different information sources in their prescribing decisions, with residents relying on their ED colleagues (15%) more than did attendings (32%; $P = .001$). The vast majority (89%) reported using a smartphone or tablet, with 44% of attendings versus 72% of residents reporting online decision support via a smart device would be useful for making antibiotic selections ($P = .001$).

In-Depth Interviews

One hundred percent of recruited participants agreed to be interviewed. Analysis was guided by constructivist theory; using both inductive and deductive methods, the research team condensed 42 codes and concepts into 5 broad themes: (1) resource and environmental factors that affect care, (2) access to and quality of care received outside the ED consult, (3) patient-provider relationships, (4) clinical inertia, and (5) local knowledge production. A detailed description of these overarching themes is provided in Table 3 and described be-

TABLE 3. Codes and Themes

Themes	Definition and codes	Exemplar quotes
Impact of resource and environmental factors	How accessibility and availability of material and immaterial sources shape the ED provider's antibiotic decision-making process: <ol style="list-style-type: none"> 1. Accessing information databases 2. Employing diagnostic testing 3. Influence of ED volume and time constraints on care 4. External institutional influence 5. Resource constraints that prevent optimal treatment 	<p>A. "However, as we get busier I can't say I never prescribed an antibiotic that I didn't need to, because you're busy and you need to get through patients." – Attending, female, 2 years</p> <p>B. "I would consider needing that rapid [diagnostic] test [for drug resistance]. To be able to have the luxury of honing in my diagnosis or being able to choose a narrow spectrum, or even an appropriate spectrum." – Attending, male, 8 years</p> <p>C. "We see a very broad spectrum of disease, so being able to keep up with all the antibiotic regimens and recommendations from all of the specialties I think is difficult." – Attending, male, 12 years</p>
Access and quality of care received outside the ED consult	Medical assistance patients seek or acquire before or after their medical encounter in the ED and how this care may or may not impact the trajectory of their treatment in the ED: <ol style="list-style-type: none"> 1. Instructions for care given to patient following their discharge 2. Care received for the patient's illness outside of the ED 3. Unscheduled returns to the ED 4. Provider assumptions about non-ED providers 	<p>A. "Whether or not I treat with antibiotics depends on whether or not there's evidence, but I often will set a little threshold, especially if I'm concerned about the patient's ability to follow up, which is often an issue." – Attending, female, 10 years</p> <p>B. "If it's an outpatient, usually I use the broad-spectrum antibiotics because we don't have the luxury usually of following the patients and seeing if it's working." – Resident, male, 4 years</p> <p>C. "If they don't have a car or it takes them two hours on the bus. Then you might just say screw it, just go ahead, and we'll give the antibiotic. That plays a huge role. That's just emergency medicine." – Did not provide demographic characteristics</p>
Patient-provider relationship	How the social dynamic between a healthcare consumer and their attending physician or resident shape rapport and affect healthcare decision making: <ol style="list-style-type: none"> 1. Patient's ability and willingness to follow their provider's instructions 2. Patient's actual or perceived desires for the treatment of their illness 3. Provider assumptions about the patient's treatment 4. Demographic characteristics of the patient population and how they influence the care received 	<p>A. "We want to give the patient an explanation for their vague abdominal pain that's not appendicitis. And so we call it a UTI and treat 'em with antibiotics." – Attending, male, 4 years</p> <p>B. "We've created an expectation in the population. They come asking for antibiotics, 'cause the last three times they came, they were told they needed them. So they come time number four and say, 'I'm here for my antibiotic.' And we think they're crazy. When in reality, it's like no, we trained them to come back and get an antibiotic." – Attending, male, 11 years</p> <p>C. "It's almost like opiates. When the physician is just so beaten down that they don't want to argue anymore with the patient. We all want to be that person who has that hard discussion and educates the patient, but sometimes it's really hard to do that." – Attending, female, 6 years</p>

Clinical inertia	<p>Methods of practice or modes of thought that are acquired through the continual adaptation to a specific environment, so much so that the behavior becomes normalized and often unconscious. In some cases the methods of practice or modes of thought will continue even if they are irrational because they are so deeply embedded into the social landscape that they are perceived as routine or "right":</p> <ol style="list-style-type: none"> 1. Provider expresses concern about outcome 2. Provider's inability to make a definitive diagnosis 	<p>A. "So I think it's usually this sort of drive to make a diagnosis even when it's something that's probably early, probably viral, and just needs a little more time to declare itself." – Attending, male, 10 years</p> <p>B. "I think we try to reduce our cognitive load sometimes in the ED environment and sometimes antibiotics is a tick box of management for certain things – someone's getting admitted for asthma you give them antibiotic." – Attending, male, 22 years</p> <p>"...it may not be just simple this, or that, you know? You have to think more broadly because they decided today was the day they were coming to the emergency department." – Attending, male, 4 years</p>
Local knowledge production	<p>When administrative protocol or the expertise of ED players (providers, specialists, colleagues, researchers) through quality control measures, personal opinions or experiences generate information about antibiotic prescribing that influence clinical decision making:</p> <ol style="list-style-type: none"> 1. Providing or receiving oversight or feedback on performance 2. Employing antibiotics 3. Provider's personal experience in medicine 	<p>A. "[Having infectious disease experts in the ED makes you] more cognizant of your decision to use antibiotics or not – if they're absolutely necessary. I think it helps the entire ED, not only to having them their on shift, but also in conferences you can have better discussions about what antibiotics to use, in actual terms." – Resident, female, 2 years</p> <p>B. "My thinking has really gone away from prescribing antibiotics for abscesses based on [our study]. These patients come back every couple days for rechecks, and I know that half of them are getting placebo. They all get better just with drainage, even though they had a ton of cellulitis before, so I'm pretty convinced." – Attending, male, 14 years</p> <p>C. "I think [ID specialists] are very important especially when there are key opinion leaders locally. They came up with algorithms and had specific recommendations for antibiotics that they came and spoke to the ED faculty and gave us the protocols and basically everyone, or I personally, followed those protocols." – Attending, male, 11 years</p>

NOTE. All quotes provided in the table originate from 15 unique providers. ED, emergency department; ID, infectious diseases.

low. There was no link between provider level of confidence in prescribing (from the quantitative survey) and the major themes identified during their interviews when we compared the answers that prescribers gave on the survey with those that they gave during their interview.

Theme 1: Resource and Environmental Factors that Affect Care. ED providers expressed that they must navigate a patchwork system of insufficient resources under time constraints, which impedes antibiotic stewardship. The most frequently identified constraints were time, inadequate diagnostic testing capabilities, and perceived inappropriate or vague guidelines. Although several resources were identified that could improve stewardship (eg, patient telephone follow up and antibiograms), these were noted as not being easily accessible.

Theme 2: Access to and Quality of Care Received Outside the ED Consult. Providers acknowledged treating more “aggressively” when patient follow up was uncertain, prescribing antibiotics more readily in the absence of clinical indicators, and selecting broader-spectrum agents.

Theme 3: Patient-Provider Relationship. The majority of ED providers said they were influenced by perceived or real patient expectations. Patient education (including level of health education) and how well the provider felt they were able to communicate with the patient were important factors influencing their decision to prescribe antibiotics even in the absence of clinical indicators.

Theme 4: Clinical Inertia. Many providers revealed that they perfunctorily follow order-sets or lapse into patterns of prescription in accordance with their colleagues. However, the drive to make a diagnosis was often a deliberate, conscious habit, with lack of certainty in the diagnosis leading to provider discomfort. Multiple providers spoke at length about diagnostic uncertainty playing a role in unjustified antimicrobial prescribing.

Theme 5: Local Knowledge Production. Local knowledge, including lectures, faculty meetings, conferences, conversations between colleagues, and trainee education were identified as important factors that facilitate antimicrobial stewardship. Providers emphasized that local feedback on antimicrobial prescribing should not be punitive.

Patient-Provider Observational Study

Our sample of 10 patient-provider interactions, involving 3 ED attendings in 1 ED, revealed insights regarding how patients perceive their provider’s treatment decisions and their general knowledge surrounding antibiotics. Most patients simply wanted an explanation for their symptoms. No patient explicitly stated the desire for an antibiotic, and none requested that the provider prescribe one.

Encounters generally involved a brief set of questions and physical examination. Providers relied heavily on diagnostics; every patient received testing, with most undergoing multiple tests. Patients had limited understanding and demonstrated

poor knowledge of antibiotic use, adverse effects, or the difference between viral and bacterial infection. Many mentioned that, if antibiotics were overused, resistance in the body would build; however, none mentioned resistance at a community level. There was extremely limited communication between patients and providers. Of the only 3 interactions in which the provider indicated whether the infection was viral or bacterial, only 2 of the patients were given an explanation by their provider of why antibiotics are not as effective for the treatment of viral infections.

Discussion

Our study revealed that reasons for antibiotic overprescribing in the ED are complex and shaped by numerous factors, both internal and external to providers. Data triangulation between the 3 components of our study maximized the ability to interpret our findings. Our findings are consistent with previous research showing that barriers to implementing new guidelines are numerous and likely vary by setting and site.¹⁸ Similar to our findings, studies of European healthcare providers found that environmental (ie, time and resources) and patient-related factors (ie, patient preference) were primary barriers to antibiotic guideline adherence,¹⁹ with peer group opinion a strong predictor of antimicrobial prescribing.²⁰

Our in-depth interviews revealed that the ED providers’ ability to foster antibiotic stewardship is hindered by external health system factors. The ED, as a safety net, disproportionately provides care to low-income and uninsured patients. As a result, ED providers reported that they must not only account for the clinical scenario, but also consider the patient’s ability to obtain follow up care. For example, providers for whom patients had better access to follow up care were more likely to use a wait-and-see approach to antimicrobial prescribing for upper respiratory infections. Nearly every provider emphasized that the fast-paced environment of the ED encourages unnecessary antibiotic use. Providers stated that they often forgo diagnostic testing because of lengthy turnaround time, in favor of prescribing.

Inappropriate antibiotic use is an important patient safety issue. An estimated 142,500 annual ED visits are for adverse events associated with systemic antibiotics.²¹ Our observations of ED visits suggest providers may be prescribing antibiotics on the basis of perceived rather than actual patient expectations, consistent with non-ED literature,^{22,23,24} highlighting inadequate communication between patients and providers. Several expressed a need to “do something” for patients, including using antibiotics as a “placebo.” Given the recent focus on patient satisfaction (eg, Press Ganey scores) as an indicator of quality of care, there will likely be increasing focus on patient satisfaction in the ED by hospital administration and regulatory bodies, despite lack of evidence for improved outcomes with increased satisfaction.²⁵

The ED environment socializes providers to acquire specific behaviors and beliefs. Many participants attributed antibiotic

TABLE 4. Barriers and Facilitators to Antimicrobial Stewardship

Antibiotic stewardship intervention	Barrier	Facilitator
Antibiograms	<p>“They’re really difficult to read. And if you don’t have the knowledge on what you might be covering in the first place they’re a bit pointless.” – Attending, 6 years</p>	<p>They actually had inpatient and outpatient specific biograms, and that was actually useful, and it was also sobering. – Attending, 10 years</p>
Wait-and-see prescriptions	<p>“If you had someone who seemed very reliable and could actually verbalize to you the plan and had a working phone that would be a person I would be willing to try it with. But, in our system, often we end up not meeting all those standards, so we just give them the antibiotic.” – Attending, 14 years</p>	<p>“Somebody with a borderline infection. I’m not sure whether I think it’s truly bacterial infection or whether needs treatment, but the convenience of having to come back, they might have to wait 10 hours to be reevaluated. So I let them reevaluate themselves.” – Attending, 11 years</p>
Culture callbacks	<p>“It creates a level of comfort where physicians feel like they can order more cultures than necessary, but on the back end, the physicians or the nurse practitioners have to follow up, I feel like it probably creates a lot more extra work than necessary.” – Resident, 3 years</p>	<p>“We’re lucky here, the nurses keep track of all the cultures that we order, blood and urine cultures, and if we have not prescribed the appropriate antibiotic or didn’t prescribe antibiotics then they let the night doc know.” – Attending, 2 years</p>
Patient education	<p>“I’ve had a lot of patients come in with an agenda and because they’ve already researched the symptoms themselves they think they have something and that they’ve figured out for themselves online.” – Attending, 27 years</p>	<p>“If you have a chance to actually talk to the patient about why you are not giving the antibiotics, it makes them understand.” – Resident, 4 years</p>
Provider education	<p>“Right now, a lot of the continuing education is the exact opposite. It’s pharmaceutical industry based, trying to get you to prescribe more antibiotics in a, typically, very broad-spectrum antibiotics. And so, if there were education to counter that, that might be useful.” – Attending, 11 years</p>	<p>“The fact that I work in an academic facility with residents, fellows, faculty that are always going to ask why did you use that? Why couldn’t you have just used this? That is always staying in the back of my mind that I need to be able to clearly defend my decision to use an antibiotic in a given situation.” – Attending, 8 years</p>
Diagnostic testing	<p>“It’s easier to just kind of churn through the patients than sit and wait for a rapid strep.” – Resident, 2 years</p>	<p>“I think a completely normal urine dipstick makes a UTI less likely. It helps you pursue other diagnoses.” – Attending, 22 years</p>
Clinical decision-making support	<p>“I worry about it through the electronic health record because you definitely get pop-up fatigue, where you just don’t want to see any more pop-ups and you’re like please let me discharge this patient. Just click through all of them, you know?” – Attending, 6 years</p>	<p>“A centralized location of information, an actual website where you go to and say, this is the antibiotic and this is the condition it treats and to actually have it be free.” – Resident, 3 years</p>
Performance feedback	<p>“If people bounced back to the emergency department, it got flagged, and people reviewed that case. That was a good improvement measure you could assess.” – Attending, 4 years</p>	<p>“I always have to make sure the patient is 100 percent satisfied with their visit by the time that they leave. Or else I’ll hear about it in a bad way.” – Attending, 4 years</p>
Guidelines	<p>“The problem with guidelines in general, is there is unique patient populations. And if they’re not addressed in the guidelines, then you kinda just have to default to what you think is best.” – Attending, 10 years</p>	<p>“We love guidelines. I mean they make it easy for us and also gives us ammunition when we’re talking to the patient. We have specific guidelines that say to do this. We have specific guidelines that say to prescribe this.” – Attending, 5 years</p>

NOTE. UTI, urinary tract infection.

overuse to “knee-jerk reactions” or “the culture of the ED,” or the concept of “mindlines,” in which clinicians demonstrate shared rationales constructed from different spheres of influence, such as specialty training, peer influence, and the pressure to “conform with perceived patient preferences” rather than follow clinical guidelines.²⁶ Moreover, providers prescribed antibiotics even when they were not confident in their diagnoses, perceiving the risk of a poor outcome to be greater than individual patient risk associated with receiving an unnecessary antibiotic. Providers articulated that azithromycin prescriptions for upper respiratory prescription are perceived to be “like water” and a “safe, cheap and effective” choice and that they are thus given out “like candy.”

Although there is a great desire for a simple solution to antibiotic prescribing in a chaotic environment, the results from this study demonstrate the interplay of complex behavioral and environmental factors. Providers identified several potential facilitators to antimicrobial stewardship in the ED (Table 4), including local resources, partnering with patients to use a “wait and see” approach, callback of patients for whom microbial cultures have been ordered, patient and provider education, improved diagnostic testing, provider feedback mechanisms, clinical decision support, and more tailored guidelines. Most providers referenced pocket antibiotic guides or local or national guidelines to make prescribing decisions; however, they had a difficult time keeping abreast with evolving recommendations and frequently turned to the internet to obtain current evidence-based guidance.

Particularly unexpected was the finding that local knowledge sources, especially colleagues’ opinions, were perceived as more effective in modifying prescribing behavior than national guidelines. In fact, many providers cited specific individuals and explained how their research or opinions directly influenced their antibiotic prescription practices.

Our findings must be considered in the context of our study limitations, namely the use of a convenience sample of mainly academic EDs in 2 geographic regions, our small sample size and low survey response rate, and the observation of patient-provider interactions in a single ED with likely underreporting of many of themes in the fast-paced ED environment. Selection bias is likely given the convenience sampling and low response rate; however, these response rates are not atypical, based on previous research involving residents.²⁷ Participation in the interview may also have led to a Hawthorne effect in our observational study. Finally, we did not collect socioeconomic or demographic data on patients; however, patient responses may depend on these indicators.

Despite these limitations, we feel our study results are an important step in better understanding antibiotic prescribing in the ED, providing critical information to designing effective ED-based antimicrobial stewardship interventions, namely the importance of local knowledge generation rather than a “one size fits all” approach. Potential interventions to

address barriers to change in the ED include educational outreach, feedback to the clinical care team, and process change.²⁸ Although providers are amenable to the use of novel and easily accessible resources, formal audit mechanisms may not be easily accepted or effective in an ED environment. Best practices solutions may be multifaceted, incorporating shared decision making with patients,^{29,30,31} although the burden of appropriate antibiotic prescribing falls largely on the provider. Finally, any solution to improving antimicrobial prescribing in the ED will need to take into account the patient-provider relationship and local healthcare system support to be successful. A multidisciplinary approach, incorporating behavioral sciences, may reduce barriers to behavior change in the prescribing process and aid in guiding effective interventions for antimicrobial stewardship in the ED.¹²

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