

# Perceptions of the Benefits and Risks of Antibiotics Among Adult Patients and Parents With High Antibiotic Utilization

Jennifer O. Spicer,<sup>1,\*</sup> Rebecca M. Roberts,<sup>2</sup> and Lauri A. Hicks<sup>2</sup>

<sup>1</sup>Division of Infectious Diseases, Department of Medicine, Emory University School of Medicine, Atlanta, Georgia, USA, <sup>2</sup>Division of Healthcare Quality Promotion, Centers for Disease Control and Prevention, Atlanta, Georgia, USA

**Background.** Inappropriate antibiotic use is common. Understanding how patients view antibiotic risks and/or benefits could inform development of patient education materials and clinician communication strategies. We explored current knowledge, attitudes, and behaviors related to antibiotics among populations with high antibiotic use.

**Methods.** We conducted 12 focus groups with adult patients and parents across the United States by telephone in March 2017. Purposive sampling was used to identify participants with high antibiotic use. We transcribed the discussions verbatim and performed thematic analysis.

**Results.** We identified 4 major themes. First, participants expressed uncertainty regarding which clinical syndromes required antibiotics, and emotion often influenced their desire for antibiotics. Second, they had a limited understanding of antibiotic risks. Antibiotic resistance was viewed as the primary risk but was seen as a “distant, future” issue, whereas immediate adverse events, such as side effects, were minimized; however, patients expressed concern when told about the risk of serious adverse events. Third, they prioritized antibiotic benefits over risks in their decision-making, both due to an inaccurate estimation of antibiotic risks and/or benefits and a tendency to prioritize instant gratification. Fourth, most participants were willing to defer to their clinicians’ decisions about antibiotics, especially if their clinician provided symptomatic treatment and anticipatory guidance.

**Conclusions.** Patients have a limited understanding of antibiotic risks, potentially explaining why they are willing to try antibiotics even if it is unclear antibiotics will help. Educating patients on the potential antibiotic risks versus benefits, rather than just antibiotic resistance, may have a bigger impact on their decision-making.

**Keywords.** antibiotic risks; antibiotic stewardship; patient perceptions; qualitative study.

Inappropriate antibiotic prescribing is common [1, 2]. Although antibiotic prescribing for children has decreased, antibiotic prescribing for adults remains unchanged [3, 4]. Multiple factors likely contribute to this decreased prescribing for children including the following: the decline in pneumococcal disease due to introduction of pneumococcal conjugate vaccines [5]; educational efforts aimed at transforming parent and/or pediatrician antibiotic use; and changes in professional society guideline recommendations for diagnosis and treatment of common pediatric infections [6–8]. Qualitative research studies have shown that patients’ knowledge about antibiotics improved over the past few decades, but most studies focused on parents’ attitudes toward antibiotic use in children rather than adult patients’ attitudes about their own antibiotic use [9–15].

Over the last decade, an increasing number of studies have illustrated potential harms associated with antibiotic use, including *Clostridioides difficile* infection and serious adverse drug reactions [16, 17]. Antibiotics are responsible for a significant number of emergency department visits for adverse drug events [18]. Communication about these risks could potentially mitigate unnecessary antibiotic use among patients. Although studies show that patients are aware of antibiotic side effects [12, 15], little is known about patient knowledge and perceptions of specific risks and how they incorporate risk into their antibiotic use decision-making. The few studies that do examine patient perceptions of antibiotic risk primarily focus on antibiotic resistance rather than more immediate adverse drug events [19, 20].

To fill this gap, we sought to explore adult patients’ and parents’ knowledge and attitudes of antibiotic risks and understand how they incorporate this information in their antibiotic use decision-making. This information informed the development of materials for the Centers for Disease Control and Prevention (CDC)’s “Be Antibiotics Aware: Smart Use, Best Care” campaign. The CDC’s previous antibiotic use messaging targeted parents and pediatricians and highlighted antibiotic resistance as the main risk of antibiotic overuse. The goal of this study was to understand whether adult patients viewed

Received 31 August 2020; editorial decision 30 October 2020; accepted 2 November 2020.

Correspondence: Jennifer O. Spicer, MD, MPH, 46 Armstrong Street, Woodruff Extension Building, Office 211, Atlanta, GA 30303 (jennifer.spicer@emory.edu).

Open Forum Infectious Diseases® 2020

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DOI: 10.1093/ofid/ofaa544

antibiotic risk differently and determine whether other antibiotic risks, such as adverse drug events, would be more effective for public health messaging.

## METHODS

### Study Design

We conducted 12 focus groups (6 groups of parents and 6 groups of adult patients) during March 2017 from various US regions. Each 60-minute focus group was conducted via telephone using Adobe Connect (Adobe Systems Inc., San Jose, CA) to facilitate antibiotic message testing. Three participants were recruited for each focus group, which allowed discussion of diverging opinions while also keeping group size manageable for a telephone discussion. Informed consent was obtained, and the study protocol was approved by the institutional review board at the CDC and ICF International, the consulting firm that conducted the focus group. Each participant received \$35 as compensation.

### Participants and Recruitment

We used a stratified, purposive sampling method to identify parents and adult patients most likely to expect or request antibiotics. A professional recruiting firm identified and screened participants via phone using a database of potential, opt-in volunteers. We recruited participants from states with the highest antibiotic prescribing rates from all 4 census regions in the United States (New York, Rhode Island, Kentucky, Louisiana, Mississippi, Tennessee, West Virginia, Iowa, Nebraska, Utah), and we restricted participation to individuals with at least a high school degree between the ages of 21 and 45 who self-reported receiving at least 1 antibiotic prescription in the prior 12 months. Half of the participants were recruited from the South census region, which has the highest outpatient antibiotic prescribing rates of any region [3, 21]. We restricted participation to women because they receive antibiotics at higher rates than men [21], and women tend to be the healthcare decision-makers in families [22].

### Patient Consent Statement

Written consent was obtained from participants, and the study design was approved by the institutional review board at the Centers for Disease Control and Prevention and ICF International.

### Discussion Guide

A discussion guide was created by a moderator trained in qualitative methods with input from CDC content experts. Topics included perceptions of antibiotics, expectations for antibiotics, reaction to not receiving antibiotics when desired, knowledge and perception of antibiotic risks, and response to antibiotic message testing (eMethods in the Supplement).

### Data Analysis

Focus groups were audio recorded. Notes were taken during sessions and discussed afterwards to identify emerging themes. Data collection continued until thematic saturation occurred. Recordings were transcribed verbatim and analyzed using MAXQDA Version 2018.2 (VERBI Software GmbH, Berlin, Germany). Two investigators (J.O.S. and R.M.R.) independently coded all transcripts using inductive and deductive codes. Differences were discussed and reconciled until 100% agreement was reached. Thematic analysis was used to identify themes.

## RESULTS

Fifteen parents and 16 adult patients participated. All participants were women. Table 1 summarizes participant characteristics. Thematic analysis revealed 4 major themes regarding participant perceptions of antibiotics.

### Theme 1: Uncertainty Regarding When Antibiotics Are Necessary

Participants understood antibiotics were not necessary for all infections but were confused about when they were needed. Multiple factors affected their perception of when antibiotics were indicated including disease type, symptom severity, and emotional responses (Table 2).

### Disease Type

Participants believed that certain disease characteristics (eg, microorganism type or clinical syndrome) indicated that antibiotics were necessary. Although many participants understood that antibiotics treat bacterial but not viral infections, they had difficulty identifying which clinical syndromes represented bacterial versus viral infections.

All participants who mentioned ear infections, strep throat, and sinusitis thought those were bacterial infections that universally required antibiotics, but they had mixed interpretations when discussing “colds” and “flu”. Some individuals

**Table 1. Characteristics of Women Participating in Focus Groups About Antibiotic Use**

Characteristics	Participants (n = 31)
Mean age (range), years	36 (22–45)
Participant Type	
Adult patient	16 (52%)
Parent	15 (48%)
Ethnicity, n (%)	
African American	8 (26%)
White	15 (48%)
Hispanic/Latino	8 (26%)
Highest Education Completed, n (%)	
High school	1 (3%)
Some college	13 (42%)
College degree	11 (35%)
Graduate or professional degree	6 (19%)

**Table 2. Factors That Influenced Participants' Desire for Antibiotics**

Factor	Illustrative Quotes
<b>Disease Type</b>	
Bacterial versus viral	"My understanding is I use antibiotics for any type of bacterial infection." "If the kid has a virus, then you can't give antibiotics to a virus, it's not going to do anything."
Clinical syndrome	"Most of the time my daughter's been on antibiotics has been for ear infections" "I know when I have a chest infection and, you know, bronchitis, and I know that taking a Z-pack, azithromycin, really helps me very quickly."
<b>Symptom Severity</b>	
Intensity	"I think that they're necessary for certain things, and I know my child, and I know when she's gone to that next level of, you know, screaming pain with ears or things like that that require antibiotics so, um, generally when I take my daughter to this doctor, I know that she needs those antibiotics because she's at that level!"
Duration	"If I just got sick within a day or two, then I should know better than to even go request an antibiotic. [The doctor] probably does know right. But if it's something that I've had, for let's say a week, and I haven't felt any better . . . nothing's getting better, nothing's improving. At that point, you know, again, like somebody else said, why would I want to waste my time and wait another week feeling horrible? So I think it depends on the time—how long you've felt this way, what your symptoms are, have they gotten any better?"
<b>Emotional Response</b>	
Safety	"I feel like antibiotics are very necessary for keeping my child healthy. My son had a whole batch of ear infections, and the antibiotics were very helpful in restoring his health. And I feel like, when he's sick, I want to do everything in my powers to help him get better. And antibiotics are usually the best tool to help him get better."
Comfort	"No, I would be very disappointed and upset because I wasted my time waiting for my appointment day, and then waiting in a waiting room to be told, "Well, I cannot give it to you, wait 2 or 3 days. I wanna feel better right now, I don't wanna wait two or three days."

recognized that those were viral infections and would not respond to antibiotics, whereas others thought antibiotics would help.

### Symptom Severity

Most participants expressed that "severe" illnesses indicated antibiotics were necessary. They defined "severity" using either symptom intensity or duration, especially if symptoms lasted beyond 1 week. One individual said:

*I was sick for 10 days...so I thought I needed an antibiotic. I went to the doctor, "No, you don't, it's viral..."...I thought after a week and a half I should have been better, but it just happened to be one of those long dragged out illnesses with whatever virus was going around.*

### Emotional Response

Emotion influenced the desire for antibiotics because participants believed that antibiotics provided comfort or safety. Adults, in particular, mentioned the importance of antibiotics for offering comfort in the form of symptom relief. One participant said:

*When you don't feel good, you're looking for anything to help...anything that will provide you some sort of relief.*

Many participants said antibiotics prevented illnesses from worsening, although parents seemed to fear the consequences of not treating infections in their children more than adult patients. One participant commented:

*If kids need [antibiotics], they need it. I had a cousin who was along those lines and was just doing drops in her baby's ears when the baby clearly had an ear infection, and the boy ended up having all these hearing problems. So, I guess I caution on the side of if they need it, they need it, and we have to keep them safe.*

### Theme 2: Limited Understanding of Antibiotic Risk

Participants were concerned about "overusing" antibiotics, but their understanding of specific antibiotic risks was incomplete and primarily shaped by personal experiences, as demonstrated by 5 subthemes (Table 3).

#### Lack of Knowledge

Participants had difficulty identifying "real risks" of antibiotics. Many said they had not personally experienced significant issues when taking antibiotics, explaining why they were not concerned. When they did describe risks, they identified antibiotic resistance as their main concern, but their depth of understanding of resistance and how it developed varied dramatically. Participants frequently mentioned side effects but stated that they were not real risks. Allergic reactions and microbiome disruption were mentioned by a few individuals who had previously experienced those issues; no one spontaneously mentioned *C difficile* infection.

#### Minimizing Consequences

Although antibiotic side effects were frequently mentioned, most participants believed they were not serious or life-threatening, and they used dismissive language to describe them, like "normal stuff" and "little stomachache". Side effects were viewed as expected, unavoidable consequences of taking medications, but not as "harmful". One participant explained:

*I expect there to be side effects. I don't expect there to be harm...Cause I see them as different. Side effects are just*

**Table 3. Participants' Knowledge and Attitudes Regarding Risk Associated With Antibiotic Use**

Themes	Illustrative Quotation
Lack of knowledge	<p>"When I take them, I don't imagine that there are any, like real risks. I'm sure that there are, but I don't think that there are"</p> <p>"I'm not really concerned. There are other things to be concerned about I think (laughing). But I've never really had an adverse reaction at all to antibiotics, so it's not something I worry about too much."</p>
Minimizing consequences	<p>"I've always been aware that there's some degree of risk with taking them but . . . I mean, there's a degree of risk with walking outside when there's 10 inches of snow on the ground. So it's with anything else in life—you have to sort of take it with a grain of salt"</p> <p>"Just the standard side effects. Um . . . but I don't know, I'd say I worry less about the side effects of antibiotics than I do about, um, pain killers and, you know, some of the addictive drugs that are prescribed to treat pain"</p>
Risks uncommon	<p>"I think for the most part I feel like, maybe because I personally haven't had any harmful side effects that, um, you know, that it's not the, you know, common thing. But, if it is, um, more than I know then, you know, it's telling me something new"</p> <p>"Any drugs that you take, there's side effects. There's always a laundry list they have to put on there to cover themselves. I think that's why I say "standard" [side effects] because in most cases you don't suffer the side effects; and percentages, if you did the research, are very low . . ."</p>
Requires repeated use	<p>"I'm not so concerned [about harm] because they don't get [antibiotics] all the time"</p>
No immediate adverse consequences	<p>"I think that people should not be prescribed or should not ask for antibiotics unless it's truly necessary. Um, because, again, in the future, when you really do need an antibiotic, you might have resistance, and there might not be anything they can do to help you"</p>

*uncomfortable...I mean unless the side effect is death (laughing), which is sometimes listed, but there's a difference to me between side effects and harm in level of seriousness.*

Side effects listed by patients included fatigue, dizziness, nausea, decreased appetite, heartburn, and rashes. Diarrhea was the only side effect consistently mentioned as concerning, and this was only among parents because they were worried about diarrhea causing severe dehydration and hospitalization.

#### **Risks Uncommon**

Participants recognized that all medications have risks, but they thought true harm occurred infrequently. Perception of the likelihood of adverse reactions to antibiotics was influenced by whether participants had any prior negative experiences with antibiotics. Lack of negative experiences supported their perception that antibiotics were safe. One participant said:

*Maybe because I haven't heard of [C. difficile infection], I think that it's probably rare. So I wouldn't be overly concerned.*

#### **Requires Repeated Use**

Most participants believed that repeated antibiotic use was necessary before they would suffer any adverse consequences from antibiotics. When asked to provide thoughts on the message, "Antibiotics may do more harm than good," one participant said:

*I think it's a little harsh. Maybe it may do more harm than good...it's a fair warning, but I guess I would appreciate them saying, "May do more harm than good when they aren't needed and abused over time." I don't want somebody to think that if they take an antibiotic one time and they didn't need it that it may cause them harm.*

#### **No Immediate Adverse Consequences**

Many participants described harm as a distant future event, primarily referencing antibiotic resistance. Although resistance worried them, they did not see it as an immediate consequence of antibiotic use, so it was not a serious concern. One participant expressed:

*I guess at the moment I assume that I have no resistance, so it's not a serious concern. But, if I were to get an infection, and the infection was resistant to the antibiotics...then it would be quite worrisome.*

The one antibiotic risk that was described as an immediate adverse consequence of antibiotic use was allergic reactions, but this was only mentioned by individuals who had previously experienced one.

#### **Theme 3: Prioritizing Antibiotic Benefits Over Risks**

When weighing the risks and benefits of antibiotics, participants prioritized potential antibiotic benefit over risk, often focusing on the presence or lack of antibiotic benefits in their discussions. In addition, any mention of antibiotic risks usually referenced antibiotic resistance or minor side effects, which appeared to influence how they weighed antibiotic risks and benefits.

#### **Inaccurate Estimation of Antibiotic Risks and Benefits**

Participants made statements demonstrating their tendency to overestimate antibiotic benefits and underestimate risk. Overestimating antibiotic benefit was common, especially for persistent illnesses. After experiencing symptoms for 1 week, most individuals believed that antibiotics were necessary and wanted to take antibiotics. For example, one participant stated that she would try antibiotics "if I think there's even a chance that I'll get better quicker".

This willingness to try antibiotics even in the setting of a small likelihood of success was due to the perception of minimal risk associated with antibiotic use. This belief led some



participants to state that the main risk of taking unnecessary antibiotics was simply “not getting better”. When participants were told that “antibiotics can do more harm than good,” many changed their perception of the relative risks and benefits of antibiotics and more carefully considered their decision to take antibiotics:

*...it definitely makes me pause. I never really think about antibiotics being harmful. I just think about it maybe being ineffective. So it's thought-provoking for sure...it makes me a little nervous...*

Some participants expressed that if risks were high, that would definitely affect their decision-making:

*you would hope that the benefits would outweigh the risks. But if the risk is high, then I would rather just try to find another route to cure whatever the situation is at the time.*

#### **Prioritization of Instant Gratification**

Participants often described antibiotics as a “quick fix” that provided immediate benefit, whereas risks were seen as distant consequences. Although many participants were concerned about antibiotic overuse leading to antibiotic resistance, their desire to get better immediately superseded concerns about the future possibility of antibiotic resistance. One individual said:

*I'm kind of careful about [taking antibiotics] just because I know that they build up in your system and may not work when you actually need them, so I want to be careful about when I need to take them. But, when I'm sick, and I feel like there's nothing else that's gonna snap me out of it, I want it. I desire it. I crave it. I just want to get better, and I know antibiotics are like magic sometimes.*

A few participants were concerned about the possibility of immediate risks, such as severe side effects or allergies, rather than just the future risk of antibiotic resistance. These individuals were more likely to carefully consider the relative risks and benefits of antibiotics, as demonstrated here:

*If there's something that I know will help my child, I will go ahead and give that medicine. But if I feel like it's too strong or if I've seen my baby have [an] antibiotic breakout, then I wouldn't give it.*

#### **Theme 4: Willingness to Defer to Clinicians**

Participants were often willing to defer to clinicians' advice about antibiotics. Most participants expressed trust in clinicians

because of their professional expertise. One individual said “my opinion shouldn't sway if they're going to give an antibiotic or not because that's their professional opinion that I know nothing about”. Most participants were willing to defer to clinicians' recommendations even if they had initially expected a prescription for antibiotics, as illustrated here:

*I think there have been times when I know my body really well, and I know when I have a chest infection...you know, bronchitis... that taking a Z-pack, azithromycin, really helps me very quickly. So there have been times that I tell a doctor in the past, “This works for me. I'm experiencing the same symptoms.” And I let them know that. But, of course, I defer to them if they think I'm wrong.*

A few outliers were adamant about getting antibiotics when they went to their clinician, usually in the setting of prolonged symptoms.

Participants did mention a few factors that affected their level of trust in clinicians' recommendations, especially if it deviated from their own expectations (Table 4). Many participants described the importance of good communication skills, such as listening to the patient and explaining the diagnosis, and a few emphasized their desire for symptomatic management and anticipatory guidance, as stated here:

*I would be satisfied with the visit if they were able to give me other advice, or what to do, or what the child should take to remedy the problem that we have...I would trust the doctor, as long as they gave me another something that we need to do.*

Participants never mentioned clinicians discussing antibiotic risks. In fact, one participant was surprised that her physician had never discussed these risks, including *C difficile* infection:

*I'm surprised that I never heard of such a thing, and I feel then that there hasn't been any awareness in regards to the side effects. My doctor never mentioned [it] before. And I've taken antibiotics for different reasons.*

## **DISCUSSION**

Four major themes emerged regarding participants' views of risks and benefits of antibiotic use: (1) uncertainty regarding when antibiotics are necessary, (2) limited understanding of antibiotic risk, (3) prioritizing antibiotic benefits over risks, and (4) willingness to defer to clinicians' decisions about antibiotics. This information has been used to inform the CDC's Be Antibiotics Aware campaign and can also be used to guide clinician communication with patients.

**Table 4. Factors That Affected Participants' Willingness to Accept Their Clinician's Recommendations**

Factor	Illustrative Quote
Continuity of care	"If I get [my] doctor, I'll ask him, or I'll go online. But sometimes if it's a fill in [doctor] . . . you know, I don't feel as comfortable (laughing), and then I go home and check on the internet."
Diagnostic certainty	"I mean, it depends on so many different circumstances. My understanding is it's hard to tell if it's a virus or bacterial infection so, if he's unsure, and then says, 'You know, at this time, I don't think you should take antibiotics. Come back in a week if you still feel bad'. . . that really bothers me because I am busy. I have work to do, and I don't have time to just be sick for another week and wait how I feel and come back. So, yeah, I mean, if that's what would happen, I would be frustrated. Um . . . and not consider it a successful visit. If though, you know, he said with certainty that this is not, you do not have a sinus infection, you have a cold. You know, then okay, then I'm not gonna take an antibiotic, it won't do anything anyways."
Illness severity	"It would depend on the particular scenario. I might get a second opinion, um, but if he really says I don't need it, then I guess I'd be satisfied, but it would depend on how sick my child was and how in pain he was."
Alternative treatment option	"Like I said, I'd be open to hearing what alternative therapy he could provide me. And if he had nothing, then I might insist on the antibiotic. If I know that they'll work."
<b>Communication</b>	
Listen effectively	"My thing is, I would really want clear communication with my health professional. I think it should be between how I feel about it and what they're suggesting. For example, I may be recommended to take something that I don't want to take or like, 'Oh, I've taken that before, but it didn't work for me.' So they should listen instead of saying, 'Oh, but, you know, it will work this time. Try it again. Let me know how you feel. Come back in two weeks'."
Explain diagnosis	". . . when she had hand-foot-and-mouth. She had this awful rash, and I thought she had an infection, so I probably went in asking for antibiotics. But then when they explained it to me (and I probably looked it up on my phone when they stepped out of the room), when they explained it to me and I did my own little fast research, it was clear that it was a virus and it wasn't going to be treatable, so I took their advice."
Anticipatory guidance	"Well, you know, I think that it would most likely be the doctor would give me some idea of what the progression should be. If we've already kind of worked our way through the bad part of the sickness, and the doctor feels confident that I can be able to see some remarkable changes in the next two days, I would trust the doctor to see if those changes actually happen."

Public educational campaigns aimed at decreasing inappropriate antibiotic use in the United States have stressed that antibiotics are not always necessary and antibiotic overuse can lead to antibiotic resistance [23]. Most participants appeared to have internalized those messages. They knew that antibiotics were not effective against viruses, consistent with prior studies [9, 15, 24], but they had trouble identifying which clinical syndromes

represented viral versus bacterial infections. Participants also believed that antibiotics were indicated if symptoms were severe or prolonged regardless of their clinical syndrome. Adult patients, in particular, thought symptoms lasting longer than 1 week required antibiotics; however, some symptoms, such as cough, can persist for weeks after viral illnesses [25]. Based on these findings, new patient education materials for the CDC's Be Antibiotics Aware campaign highlight that clinical syndrome, rather than length of illness, determine whether antibiotics are necessary.

However, providing that information alone is unlikely to decrease antibiotic use if parents and adult patients continue to view antibiotics as a relatively risk-free intervention. Most participants in our study had a poor understanding of the risks associated with antibiotic use. They thought antibiotic resistance was the primary risk and had a varied understanding of what that meant, as shown previously [15, 19, 26]. Despite this knowledge of resistance, instant gratification drove their decision-making. Immediate symptom resolution was prioritized over the potential future risk of resistance, and few other antibiotic risks were recognized. Participants mentioned side effects but used dismissive language when describing them, which suggests that side effects did not significantly impact participants' decisions regarding whether to take antibiotics. This finding demonstrates that we need to emphasize the frequency and severity of antibiotic adverse reactions, as done in the new Be Antibiotics Aware patient education materials.

Prior studies have shown that patients overestimate benefit and underestimate risk for many diagnostic tests and treatments [27]. To our knowledge, this study is the first to suggest this also applies to antibiotics. Some participants mentioned previously receiving antibiotics for acute bronchitis or other illnesses typically caused by viruses; because their symptoms resolved after antibiotics, they assumed antibiotics were responsible for their improvement, even though studies have shown antibiotics do not hasten symptom resolution in such cases [28, 29].

This phenomenon explains why patients frequently request antibiotics for conditions where antibiotics have minimal, if any, benefit. For acute bronchitis, antibiotics do not shorten symptom duration [28], and the number needed to treat to prevent 1 complication is approximately 4000 patients [30]; in contrast, the number needed to harm to result in 1 visit to the emergency department for an adverse event was 1000 [18, 31]. Our findings suggest that using this type of numerical data about the relative risks and benefits of antibiotic treatment may lessen desire for unnecessary antibiotics.

Clinicians cite patient pressure for antibiotics as a reason for unnecessary prescribing in the outpatient setting [32]. Recent studies have demonstrated that parents do not need an antibiotic prescription to be satisfied with their visit; instead, they want reassurance that their child is safe and advice on symptom relief [11, 15]. Our study shows that adult patients are also

willing to defer to clinicians' recommendations if antibiotics are unnecessary, although many insinuated that they expect alternative options for symptom relief and anticipatory guidance. To address this finding, the CDC developed patient education handouts that clinicians can use for this purpose.

Communication skills training among clinicians has been shown to reduce inappropriate antibiotic prescribing [14, 33, 34]. Our findings suggest that clinicians should discuss serious antibiotic risks with parents and adult patients, especially if antibiotics are requested. The risk of antibiotic resistance does not seem to prevent patients' request for antibiotics, likely because they perceive this as only occurring after repeated antibiotic use. Discussing adverse drug events, such as *C difficile* infection and serious drug reactions, may be more impactful. Educating clinicians on the number needed to treat and number needed to harm for conditions where antibiotics are frequently prescribed could empower them to use this information to correct patients' inaccurate estimation of antibiotic risks and benefits.

Our study has limitations. The qualitative design provides a detailed description of patients' perceptions of antibiotic use; however, we cannot quantify the frequency of these beliefs. We only had 12 focus groups in our study, but we reached thematic saturation. Our purposive sampling technique allowed us to identify participants from populations with high antibiotic use but limits the generalizability of our findings; in particular, we did not include any men or individuals with education less than a high school degree in this study. We recruited individuals from demographic groups and geographic regions with high antibiotic utilization, but this does not guarantee that individuals within our study had a personal history of frequent antibiotic use. To mitigate this issue, we restricted participation to individuals who reported that they had used antibiotics at least once in the prior year.

## CONCLUSIONS

We found that parents and adult patients may overestimate benefits and underestimate risks of antibiotic use. They see antibiotics as safe except for the future possibility of antibiotic resistance. Previous public health messaging has emphasized antibiotic resistance as the main risk of antibiotic overuse; however, our findings show that this message is unlikely to reduce patient demand for antibiotics. Instead, health messaging should focus on educating patients about both the frequency and potential severity of antibiotic adverse events. Patients appear willing to listen to clinicians' recommendations about antibiotic use as long as they are offered medications for symptomatic relief and provided with information about expected illness duration. Training clinicians to accurately and effectively communicate antibiotic risks and benefits could decrease inappropriate antibiotic use. Patient and clinician educational materials and clinician communication training (CDC Antibiotic

Stewardship course, Module 6) can be accessed on the CDC's website ([www.cdc.gov/antibiotic-use](http://www.cdc.gov/antibiotic-use) and [www.train.org/cdctrain/training/training\\_plan/3697](http://www.train.org/cdctrain/training/training_plan/3697)).

## 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

We acknowledge additional staff from the Centers for Disease Control and Prevention for their contributions to the study: Austyn Dukes, Dr. Katherine Fleming-Dutra, Rosa Herrera, Kelly O'Neill, Meredith Reagan, and Kathryn Wiedeman. We thank ICF International for their role in planning and conducting the focus groups and developing the Be Antibiotics Aware campaign materials.

**Author contributions.** J. O. S. and L. A. H. developed the study design. J. O. S. and R. M. R. performed the data analysis. J. O. S., R. M. R., and L. A. H. interpreted the data and provided critical analysis. J.O.S. wrote the manuscript with critical editing and feedback from all authors.

**Disclaimer.** The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.

**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.

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