

POPULATIONS AT RISK

Patterns and Determinants of Inappropriate Antibiotic Use in Injection Drug Users

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BACKGROUND: Inappropriate antibiotic use contributes to the emergence and spread of drug resistant infections. Though injection drug users are at increased risk for drug resistant infections, few studies have examined antibiotic use in this population.

OBJECTIVE: To understand patterns and determinants of antibiotic use among injection drug users.

METHODS: Five focus groups were conducted with 28 current injection drug users recruited from a syringe exchange program in Philadelphia and analyzed using the constant comparative method to identify emergent themes. Twenty-six participants also completed a written survey instrument.

RESULTS: Injection drug users reported frequent antibiotic exposure, with 12 of 26 participants reporting use of antibiotic medications at least once in the previous 30 days. Participants reported several patterns of antibiotic use that were potentially harmful, including delays in seeking medical care, failing to fill prescriptions, obtaining antibiotics from non-provider sources, and poor adherence to prescribed regimens. The major determinants of inappropriate antibiotic use were delayed recognition of severity of illness, reluctance to wait to be seen, previous mistreatment by providers, lack of insurance, prioritizing purchasing drugs of abuse over antibiotics, forgetting to take antibiotics because of distractions that accompany drug use, concerns about interactions between antibiotics and other substances, and an irregular diet. Additionally, injection drug users commonly misunderstood the concept of antibiotic resistance and equated it with tolerance.

CONCLUSIONS: Injection drug users reported potentially dangerous antibiotic use behaviors and described determinants of these behaviors. Outreach and educational interventions to improve antibiotic use should target high-risk populations, such as injection drug users, and consider their distinct antibiotic use behaviors and determinants.

KEY WORDS: antibiotics; adherence; injection drug use; self-medication.

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INTRODUCTION

Inappropriate antibiotic use contributes to the emergence and spread of drug resistant infections, one of the most pressing public health problems of our time.^{1–5} In efforts to reduce drug resistance, previous research has sought to understand and improve antibiotic use in the general population.^{6–11} Drug resistant infections are a particular problem in individuals who inject drugs such as heroin and cocaine.^{12–19} However, scant research has examined the potentially unique antibiotic use behaviors or the factors that contribute to inappropriate antibiotic use in this group.

Inappropriate antibiotic use encompasses (1) unnecessary use of antibiotics to treat non-responsive conditions and (2) suboptimal use of antibiotics to treat antibiotic responsive conditions, including use of overly broad agents, incorrect drug dosing or duration, and poor drug adherence.¹ Indirect evidence suggests that several examples of inappropriate antibiotic use may be more prevalent among injection drug users than among the general population. First, injection drug users have frequent acute infections and may therefore encounter more opportunities to use antibiotics both appropriately and inappropriately.^{20–22} Second, they are at risk of developing abscesses at injection sites,^{23,24} and although most abscesses can be effectively treated with incision and drainage alone, physicians frequently treat them inappropriately with antibiotics.²⁵ Third, active drug use is associated with poor adherence to medications.^{26–31} Finally, injection drug users may have distinct types of inappropriate antibiotic behaviors beyond those seen in general populations. In a study of injection drug users in San Francisco, 16% reported self-treating infections with antibiotics they had purchased on the street.²⁴

As a step in developing an intervention to improve antibiotic use among injection drug users, we conducted the current qualitative study to understand the range of antibiotic use behaviors and the factors or determinants that contribute to

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inappropriate antibiotic use in this population. Our study considered antibiotic use through three stages: (1) seeking care for infections, (2) obtaining antibiotic medication, and (3) adhering to an antibiotic regimen.

METHODS

We used focus groups to explore and understand patterns of antibiotic use in a sample of individuals who inject drugs.³² We used a grounded theory approach to allow for unpredicted themes to emerge during analysis of the focus group content.^{33,34} In addition, a written survey instrument was utilized to obtain social, behavioral, and health-related information about focus group participants. The Institutional Review Board of the University of Pennsylvania approved this study.

Participants

Injection drug users were recruited by the principal investigator (J.S.) and a research assistant at five free syringe exchanges in Philadelphia. Individuals utilizing the syringe exchange were invited to participate in the study by flyers taped to the outside of the syringe exchange van and by researchers stationed at a table adjacent to the van. Individuals were eligible for inclusion if they had injected any drug within the previous 30 days, were between the ages of 18 and 80 years, and spoke English. Eligible and interested participants provided informed consent and completed a brief written survey instrument, the intake questionnaire. The intake questionnaire collected demographic data and information about recent substance use and infections. After completing the intake questionnaire, each participant was assigned to attend a focus group within the subsequent week. Each participant was given a brightly colored flyer reminding them of the time and location of the focus group to which he or she was assigned.

Forty-nine participants were recruited and completed intake questionnaires. A maximum of 12 individuals were assigned to each focus group on a first-come, first-served basis. In an effort to increase female attendance, one focus group was specifically designed to include only female participants and researchers. All participants were remunerated for their time with 5 dollars after completing the intake questionnaire and 20 dollars after attending a focus group.

Focus Groups

A total of 28 participants attended five focus groups. Focus groups ranged in size from 2-12 participants and in length from 50-100 min. Focus groups met at the drop-in center of Prevention Point Philadelphia, the organization that administers Philadelphia's syringe exchange program. All focus groups were moderated by a general internist (J.S.). In addition, a research assistant attended each focus group to help with administrative procedures and to record observations about non-verbal cues and group dynamics. Following one focus group, it was discovered that two participants had not been recruited from the syringe exchange and therefore did not complete the intake questionnaire. After discussion with the Institutional Review Board at the University of Pennsylvania, the decision was made to include these two participants' anonymous comments in the analysis.

Initial focus group questions addressed (1) participants' prior infections, (2) how they cared for or sought care for those infections, (3) their experience of being prescribed or administered antibiotic medications, (4) the sources of antibiotics they had taken, (5) factors that influenced how they obtained or consumed antibiotics, and (6) their perceptions about antibiotics and the concept of antibiotic resistance. The initial questions were revised after the first and second focus group to better facilitate open-ended discussion, reduce assumptions implicit in questions, and to test emerging ideas, for example, about the role of drug-drug interactions (initial and revised guides are available by request). Focus groups were audio-recorded. Identifying information was expunged during the transcription process, and audiotapes were destroyed. All textual data were included in the analysis.

Analysis

Textual data were imported into NVivo qualitative data analysis software (QSR International Pty Ltd. Version 7, 2007). An initial coding scheme was developed based on preliminary hypotheses and concepts that emerged during the first focus group. Within the framework of grounded theory, the principal investigator (J.S.) and a research assistant in consultation with a second researcher (F.B.), used the constant comparative method of analysis³⁵ to iteratively code the text and revise the coding structure as new themes became apparent through close readings of the transcripts. Using the final coding scheme, the principal investigator and a research assistant independently coded each transcript in its entirety and reviewed their coding until they could achieve consensus. Discussions among the researchers were held throughout the period of analysis to identify patterns and themes in the data and to identify relationships among themes.

RESULTS

Of 26 focus group participants who completed the intake questionnaire, 25 were current heroin users, 22 were male, 11 were homeless, and 9 were uninsured (see Table 1). The mean age was 44 (range 27-60). Focus group participants were similar to those who were recruited but did not attend a focus group, in all sociodemographic characteristics except for sex; female recruits were significantly less likely to attend the focus group than were males (with 4 of 17 females and 22 of 32 males attending groups; $p=0.003$). Recent infections and antibiotic use were common among focus group participants; 12 reported having had at least one acute infection in the previous 30 days, and of these, all reported taking an antibiotic medication. Only four were able to provide the name of the antibiotic medication they reported having taken. The types of infections reported were soft tissue infections (abscesses and cellulitis), pneumonia, dental abscesses, urinary tract infections, and sexually transmitted infections. The most commonly reported infections were soft tissue infections, which occurred among 9 of the 12 participants reporting infections in the previous 30 days.

Fifteen free-text responses were provided to describe the source of antibiotics that 12 participants had taken to treat their recent infections. Nine of the respondents identified doctors, hospitals, emergency rooms, and/or free communi-

Table 1. Social and Behavioral Characteristics of 26 Focus Group Participants

Characteristic	N
Male	22
Race or ethnicity	
African American/Black	10
White/Caucasian	13
Hispanic/Latino	2
Other or unspecified	1
Education	
8th grade	6
12th grade or GED	12
At least 1 year college	8
Employment	
Full time (40 h/week)	5
Part time (regular or irregular hours)	5
Unemployed	10
Disabled	6
Homeless (≥ 15 of last 30 days)	11
HIV-positive	3
Health insurance	
No insurance	9
Medicaid	12
Medicare	2
Private insurance	1
VA coverage	1
Primary care provider	
No PCP	9
PCP seen within past year	11
PCP seen within past month	7
Other provider(s) seen in past 3 months	
Drug/alcohol treatment center	5
Emergency department	4
Hospitalized	6
Walk-in clinic	2
Substance use in past month	
Alcohol	9
Heroin	25
Cocaine	20
Marijuana or hashish	7
Methadone*	4
Other opioid analgesics*	6
Benzodiazepines*	11

*Data regarding the context of prescription drug use were not collected; therefore, we do not know whether these drugs were obtained by prescription or through illicit means

ty-based clinics as their sources for antibiotics. Three identified non-provider sources for antibiotics, such as a friend, woman, or house.

Focus group analysis revealed that at each of three stages of antibiotic use (seeking care for infections, obtaining antibiotic medication, and adhering to an antibiotic regimen), injection drug users reported antibiotic use behaviors that could lead to suboptimal treatment of infections and described determinants of these behaviors. Injection drug users in this study also reported accessing and consuming antibiotics appropriately, but in this paper we will focus on behaviors and determinants related to potentially inappropriate care, which are presented below by stage.

Stage 1: Seeking Care for Infections

Injection drug users in this study described a pattern of seeking care for acute infections that was characterized by avoidance or delays in seeking professional care. Four themes were associated with avoidance or delays in seeking profes-

sional care for infection. The four themes were (1) delayed recognition of the severity of illness, (2) reluctance to wait to be seen, (3) concern about mistreatment by providers, and (4) financial barriers to seeking care. We will discuss the first three themes below and will address financial barriers in a more detailed manner in the next section.

Delayed Recognition of the Severity of Illness. Individuals in this study attributed delays in seeking care to a late recognition of the infection or its severity. Specifically, they reported that use of heroin, a potent analgesic, concealed their symptoms of infection and reduced their motivation to seek treatment. One respondent reported, "I had a broken toe for the last 3 months, [and I] didn't know because I was shooting dope and killing the pain." Another stated, "When you take the dope, it masks the pain, so you don't feel as though you got something wrong."

Reluctance to Wait. Some injection drug users in the study reported that their previous experience waiting in doctors' offices or emergency departments caused them to resist seeking professional care. One participant stated, "When I get high, I can't wait. ... You ain't thinking properly." Another participant stated, "I always wait 'til the last minute [to seek care], 'til it's almost too late, 'cause I just don't have time. You go sit in the waiting room, you'll be in there all day." One participant described becoming so "mad and frustrated" with waiting in an emergency department that he left before being treated for his abscess, opting instead to perform his own incision and drainage and to obtain antibiotics from a friend.

Concern About Mistreatment by Providers. Individuals reported that prior mistreatment and discrimination they encountered towards drug users in emergency departments had driven them to delay or avoid seeking medical care. One participant said, "You do definitely get treated differently [if you are a drug user]... They definitely look down on you. Pay less attention to you." Other participants said, "They don't care about you. You're just a junkie" and "They're looking at you like you're a scum bag." Discrimination was especially apparent to participants in the management of their pain. One participant stated, "As far as antibiotics, they give you. But as far as pain medicine, ... if they know you are a drug user, you won't get no Percocets." One participant recounted, "I had cut my hands and needed stitches, and they seen my track marks.... [The doctor] didn't even want to numb me up. She just started sewing it up without anything."

Stage 2: Obtaining Antibiotics

Participants also described their processes of obtaining antibiotic medications. From this discussion, several patterns of inappropriate or potentially harmful antibiotic-related behaviors emerged. Broadly, these include (1) failing to fill a prescription for antibiotics, and (2) obtaining antibiotics from a non-provider source. The prohibitive financial cost of filling a prescription emerged as a prominent determinant of both failing to fill a prescription and obtaining antibiotics from a non-provider source.

Non-Provider Sources of Antibiotics. Individuals described a range of non-provider sources of antibiotics, including family members, friends, and other drug users. One participant recounted, "A couple of times, I knew I needed antibiotics, but I didn't go to the doctor. I just went to my mom ... or anybody I know [and asked], 'You got any antibiotics around the house?'" Another participant reported having obtained antibiotics "from family, my sister, whoever's got 'em." Others described being offered antibiotics from people with whom they were injecting drugs. "If you been high, and you in them houses, ... they [other drug users] tell you what the remedies are, and we listen because ... we high." Another participant interjected, "Right, they pull out the pills [and say], 'Take one of these.' ... You're not feeling okay and somebody say, 'Here's what you want. I'll sell you one.'" Another stated, "If you got an abscess and you in pain, you might take anything if somebody told you it might relieve the pain and get rid of the abscess." One participant pointed out that "It's never enough. It's only a couple that they didn't take."

Some respondents reported purchasing antibiotics from "people on the street." One participant reported that "They sell them, just like drugs." Another participant recounted, "I had an abscess from using needles... and this guy, we called him Doc... anything you needed, he had. ... I bought some Keflexes® [trade name for cephalexin]. Cleared the infection right up. Saved me a trip to the hospital." Regarding buying antibiotics "off the street," one participant stated, "Especially Keflex®. ... Intravenous drug users carry them a lot." Some participants noted that exchange of money for antibiotics was unusual. One described, "[There is] not a whole lot of that really going on, because when you sick you ain't looking for nobody out in the street for antibiotics."

Some participants described saving antibiotics for later. "When people get them, they stock up," stated one participant. Another reported, "I've got some [antibiotics] at home. ... I've got all types of medications that I don't finish. That I save." One participant described, "The only pills laying around my house were all these antibiotics. And whatever problem I had, I just took the same pill, to avoid going to the doctors' [office]."

The Prohibitive Cost of Antibiotics. For many participants, health insurance status and copayments determined whether they filled prescriptions for antibiotics. One stated, "I wouldn't get them if my insurance didn't pay for them. I wouldn't pay the cash, because they're too expensive." Another participant reported, "I have not gotten them [antibiotics] because they're too expensive." Even a small copayment may be prohibitive. As one participant reported, "If you don't have a dollar [the copayment], they won't give it to you. ... You could be dying."

Some participants reported that they had failed to fill prescriptions in the past because they had prioritized paying for illicit drugs over providing a copayment for medications. "I want to go buy some dope before I want to buy some antibiotics, if I'm dope sick [experiencing heroin withdrawal symptoms]." Another participant stated, "When you've got a heroin addiction, ... that's your priority. ... If your prescription costs \$20 and you need a bag of dope that costs \$10, you ain't getting that prescription."

Stage 3: Antibiotic Adherence

Although some participants reported adhering fully to prescribed regimens, others reported patterns of poor adherence,

including missing doses and not completing the full course. In addition to feeling better, the following three themes emerged as contributing to poor adherence: (1) forgetting to take antibiotics because of distractions and other demands related to drug use, (2) concern about interactions of antibiotic medications with alcohol or other drugs, and (3) an irregular diet. Additionally, individuals commonly misunderstood the concept of antibiotic resistance and conflated it with tolerance, as one might experience with opioid drugs. Concern about resistance, therefore, provided little incentive to improve antibiotic adherence.

Forgetting to Take Antibiotics: The Role of Drug Use. Injection drug users in this study reported forgetting to take prescribed antibiotics on schedule. "Sometimes it's just hard for me to remember," stated one participant. "It's like the last thing on my list." Others explicitly attributed forgetting to take their antibiotics to their drug use or addiction. One individual reported, "I had the pills sitting right there and everything, but you know, just [being] preoccupied with getting high, it kept me from doing what I needed to do." Another participant described, "When you runnin' the streets, it's different than when you got a set schedule, like you are working or you have a stable living situation, [and] you got them right there by the bedside ... or in the medicine cabinet. When you run the streets and you're carrying things in your bag, come on." Another respondent continued, "You might not even remember 'til 2 days later."

Concern About Interactions. Some participants attributed their poor adherence to a concern that antibiotic medications might interact with alcohol or other drugs. One participant reported, "What makes me stop taking them is that I do the drugs. ... I start drinking, I'm doing heroin or whatever, and I don't want to do these other pills with them, 'cause I feel like something's gonna happen. ... I'm like, 'I'll take them [antibiotics] tomorrow. I won't get high tomorrow.' Then tomorrow, I've got money, and I'm sick [experiencing heroin withdrawal symptoms], and I'm gonna get high, so I don't take it tomorrow either."

Several participants described experiencing an interaction between one antibiotic medication, cephalexin, and heroin. Specifically, they reported the belief that taking cephalexin reduced their response to heroin and even induced opioid withdrawal symptoms. One participant reported that cephalexin "takes the dope out of you... It makes me [dope] sick quicker." Another participant agreed, "It eats it up." In another group a participant described, "If you [are] taking drugs with the Keflex® [cephalexin], you won't feel the drugs, 'cause ... your system is so clean. ... I had to stop taking so many [antibiotics]... 'cause I couldn't feel my drug of choice."

Irregular Diet. Concerns about the requirement of taking antibiotics with food prevented some participants from adhering to a regimen. One participant reported, "Some of them [antibiotics], you know, eat the lining from the stomach. You have to have food in your stomach with some of them." Another participant described, "If I'm getting high, I can go days without eating, 'cause it just suppresses my appetite. ... [If directions in your antibiotic] drugs say, ... 'you got to have something in your stomach' ... I'm not gonna take it."

Beliefs About Antibiotic Resistance. Many participants stated that taking too many antibiotics could cause a situation wherein antibiotics became ineffective. However, when probed about the meaning behind this concept, most conflated the concepts of resistance, tolerance, and immunity. One participant stated, "Your body does get immune to it [antibiotic medicine]. Just like we build up tolerances for our doses of heroin and coke and stuff like that. One bag takes care of us for a while, and then we need two and then three, then four. It's just like anything else." Another stated, "The more you take them, the less they're going to work for you. ... You get immune to them."

In addition to believing that taking too many antibiotics could have untoward consequences, some participants endorsed the idea that failing to complete a course as prescribed could be problematic. Those who were concerned about the effects of poor adherence were concerned that the particular infection they were trying to treat would be inadequately treated and that their symptoms would return, possibly more severely. One said, "If you don't take the antibiotics like it's prescribed, the infection comes back on you." Another said, "Something simple can become life threatening." Few endorsed that poor adherence could be dangerous to others, except insofar as if an individual has an inadequately treated infection, then they might pass it along to others. "[If] we do stop taking them early, and the infection comes back, then we put others at risk for catching the same infection."

DISCUSSION

We have identified several inappropriate and potentially harmful patterns of antibiotic use by injection drug users that may be modifiable. One pattern was self-directed antibiotic therapy outside of supervision by a health-care professional, which included obtaining antibiotics from non-provider sources, such as family members or friends, buying antibiotics on the street, and stockpiling antibiotics for later use. Self-directed antibiotic therapy has the potential for several negative consequences. First, unmonitored individuals may be at increased risk for allergic reactions, drug-drug interactions, or other adverse events. Second, their infections may not be adequately treated, because a leftover supply of antibiotics is unlikely to be sufficient for a full course. Third, self-directed antibiotic treatment may be initiated for inappropriate indications, particularly for abscesses. A second potentially harmful pattern of antibiotic use described by study participants was poor adherence to prescribed antibiotic regimens, which included missed doses and failure to complete the full course. Both patterns of behavior (self-directed antibiotic therapy and poor adherence) led to delays in initiating or completing appropriate antibiotic therapy and could contribute to drug resistance.

Several factors contributed to inappropriate antibiotic use. Determinants were largely a function of either the mistrust between injection drug users and health-care providers or the correlates that accompany addiction. They included: delayed recognition of infection because of heroin-induced analgesia, reluctance to wait to be seen by a medical provider, concern about mistreatment by providers, lack of insurance, prioritizing purchasing illicit drugs over antibiotics, forgetting to take antibiotics because of distractions that accompany drug use,

concerns about interactions between antibiotics and other substances, and an irregular diet. Together, these factors comprise a set of barriers to the timely and appropriate use of antibiotic therapy in injection drug users. They are therefore important targets for future educational and clinical interventions to improve antibiotic use.

Clearly, many of the patterns of inappropriate antibiotic use we identified are not confined to individuals who inject drugs.^{36,37} For example, a survey of general patients in a suburban emergency room found that 17% had used leftover antibiotics without consulting a physician.³⁸ Though future research should include a control group of non-injection drug users, our findings indicate that several determinants of inappropriate antibiotic use in this group are likely to be specific to drug users. Some examples include the need to prioritize paying for heroin over paying for antibiotics, feeling discriminated against by providers because of drug use, concern about potential interactions of antibiotics with heroin, and forgetting to take antibiotics because of distraction by drug use or the demands of addiction.

The major limitation of this study is that participants were recruited using a convenience sample of injection drug users utilizing syringe exchange services in a single urban city. It is important to acknowledge that study participants may differ from injection drug users who do not use syringe exchange services in ways that may bias our findings. For example, it is plausible that syringe exchange users may be more proactive about their health and/or may have better access to medical care than injection drug users who do not utilize syringe exchanges.³⁹ Another limitation is the low rate of focus group attendance among individuals recruited, especially among women. Therefore, we do not know if the findings are generalizable to all injection drug users or to injection drug users in other geographic areas. Additionally, we did not explore the impact that addiction treatment may have on antibiotic use behaviors.

Despite these limitations, this study has important implications. The results will (1) help providers to better counsel and monitor drug-using patients requiring antibiotics; (2) identify the range of behaviors to assess in future quantitative research aiming to measure the extent and predictors of inappropriate antibiotic use in injection drug users, compare them to the general public, and measure the response to interventions; and (3) identify potentially modifiable behaviors for intervention. Interventions should aim to reduce self-directed treatment and improve antibiotic adherence by (1) educating drug users about antibiotic use and resistance; (2) improving drug users' access to medical care; (3) encouraging dialogue between patients and providers about the cost and complexity of an antibiotic regimen, food requirements, and potential interactions with drugs or alcohol; (4) evaluating use of dose reminder systems in this population; and (5) teaching providers to treat injection drug users in a non-judgmental and respectful way. In a previous study, injection drug users reported that their use of health-related services would increase if providers they encountered were less judgmental.⁴⁰

We cannot afford to ignore the problem of inappropriate antibiotic use among injection drug users, because drug resistant infections have significant health-related and finan-

cial costs to individuals and society.^{41,42} Drug resistant infections are a shared hazard and responsibility.

Patterns and Determinants of Inappropriate Antibiotic Use Identified among Injection Drug Users

Stage 1: Seeking care for infections

Patterns:

- Avoiding seeking professional care
- Delaying seeking professional care

Determinants:

- Delayed recognition of the severity of illness
- Reluctance to wait to be seen by medical providers
- Concern about mistreatment by providers
- Financial barriers to seeking care

Stage 2: Obtaining antibiotic medication

Patterns:

- Failing to fill a prescription for antibiotics
- Obtaining antibiotics from a non-provider source

Determinant:

- Prohibitive financial cost of antibiotics

Stage 3: Antibiotic adherence

Patterns:

- Forgetting or missing doses
- Not completing the full course

Determinants:

- Distractions and other demands related to drug use
- Concern about drug-drug or drug-alcohol interactions
- Irregular diet
- Misunderstanding of antibiotic resistance

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