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BRIEF REPORT

Home-Based Outpatient Parenteral Antibiotic Therapy at an Urban Safety Net Hospital: Comparing Outcomes in Persons With and Without Noninjection Drug Use

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As stimulant use and infections among persons using drugs rise nationally, evidence remains limited on how best to deliver outpatient parenteral antimicrobial therapy (OPAT) to persons using noninjection drugs. In an urban safety net population including persons using noninjection drugs, home-based OPAT completion rates were similarly high as those of non-drug-using individuals.

Keywords. discharge planning; home infusion therapy; outpatient parenteral antimicrobial therapy; people who use drugs.

Outpatient parenteral antibiotic therapy (OPAT) has well-established safety and value, but experience in safety net settings serving socioeconomically vulnerable patients remains limited. In particular, evidence for OPAT models serving patients with a history of drug use—both injection drugs and noninjection drugs—is especially limited.

People who use drugs (PWUD) are suffering rising rates of invasive bacterial infections requiring prolonged antibiotic therapy [1], making the development of improved OPAT care models a priority. However, many OPAT programs exclude PWUD due to safety concerns or apprehension that drug use may be a proxy for an unstable home environment, which can force patients to stay in inpatient settings for prolonged durations [2]. Many centers are expanding OPAT programs to include persons injecting drugs, often in an outpatient facility or monitored care settings. Emerging research has shown this to be safe and efficacious [3, 4]. However, the Infectious Diseases Society of America guidelines note a lack of studies on true home-based OPAT for people using drugs [5]. This is a critical gap for which evidence is required to develop care models to serve this important population.

At a large urban medical center serving a socioeconomically vulnerable patient population with a substantial amount of noninjection drug use, we sought to describe the safety and effectiveness of a self-administered, home-based OPAT program.

METHODS

We studied patients enrolled in a new outpatient intravenous (IV) antibiotics program during a 2-year period from September 2017 to October 2019 at an urban county medical center that primarily serves low-income, socioeconomically marginalized persons. The OPAT program is operated by an Infectious Diseases physician team, with collaboration from a home care agency and support from an on-campus infusion center. Patients were candidates for OPAT if aged ≥18 years and discharged from the hospital with at least 7 days of planned intravenous antibiotics. Patients were excluded from participation if they had active injection drug use upon hospital admission or were unable or unwilling to self-administer antibiotics. Enrollment was not limited by insurance status, as public insurance plans at the city and state level in San Francisco, California, provide coverage for OPAT. Participants received training on self-administration of antibiotics via peripherally inserted central catheters (PICCs) before hospital discharge. Once home, patients received delivery of antibiotics and weekly nursing visits for PICC care and laboratory monitoring but were otherwise responsible for self-administering their antibiotics.

We collected demographic and clinical data at the time of enrollment in the program. Drug use was categorized as recent (within last 6 months) or prior (>6 months or unknown). Drugs ascertained included cocaine, methamphetamine, heroin, fentanyl, other opioids, benzodiazepines, and dissociative drugs. Risky alcohol use was defined according to National Institute on Alcohol Abuse and Alcoholism guidelines [6] as >14 drinks/wk or 4 drinks/d (for men <65 years) or >7 drinks/wk or 3 drinks/d (for men >65 years and all women).

Our primary outcome was treatment completion of prescribed IV antibiotic regimen as an outpatient. Secondary outcomes included 30-day and 90-day rates of hospital readmission and complications. Readmissions and complications were categorized as OPAT-related if directly linked to the antibiotic therapy or the vascular access device.

Descriptive and analytic statistics were performed using Stata 16 [7]. Chi-square testing was done with the Fisher exact

Received 1 April 2020; editorial decision 26 April 2020; accepted 29 April 2020.

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DOI: 10.1093/ofid/ofaa162

test; ages were compared with Wilcoxon rank-sum tests. Data were collected as part of quality improvement activities of routine clinical care and did not meet criteria for requiring human subjects research approval.

RESULTS

Overall, 72 courses of antibiotics were administered to 70 patients over 2 years (Table 1). The median age of OPAT participants (interquartile range) was 51 (40–60) years, 69% (n = 50/72) were male, and 72% (n = 52/72) were nonwhite. The most common indication for OPAT was bacteremia (n = 22, 31%), followed by osteomyelitis (n = 15, 21%) and abscess/complex soft tissue infection (n = 9, 13%).

Antibiotic treatment courses were categorized by history of drug use and/or risky alcohol use preceding admission: Antibiotic courses were dispensed to 37 persons without and 35 persons with a history of drug or risky alcohol use. Of persons with a history of drug/alcohol use, stimulants were most frequently used (cocaine, n = 15 [43%]; methamphetamine, n = 15 [43%]), whereas 6 (17%) had risky alcohol use. As shown in Table 1, these patients were slightly younger and were more frequently white, experiencing homelessness, and HIV-positive compared with persons without drug/alcohol use.

Most persons received OPAT in their homes (n = 52, 72%). Although a greater fraction of persons without a history of drug use received home-based OPAT compared with persons with drug use history (84% vs 60%, respectively), home-based OPAT was still the most common site of OPAT delivery in both groups.

Successful OPAT completion as an outpatient was achieved in 32/35 (91%) patients with a drug or alcohol history and 33/37 (89%) patients with no history of drug or alcohol used. This difference was not statistically significant (P = 1.00) (Table 1). Among persons with any substance use (n = 35) (Table 1), we conducted a sensitivity analysis to compare OPAT completion among persons who reported recent or current substance use (n = 21) with those without substance use history (n = 37). OPAT completion was achieved in n = 18/21 (86%) of patients with current or recent drug use compared with 33/37 (89%) of patients without any drug or risky alcohol use (P = .92). Finally, we performed an additional sensitivity analysis to examine the outcomes of home-based OPAT treatment completion in PWUD. Among persons with a history of drug or risky alcohol use, 20/21 (95%) courses of self-administered, home-based OPAT were completed successfully vs 12/14 (86%) courses completed among PWUD receiving non-home-based OPAT (P = .55).

Overall, 30- and 90-day hospital readmission rates were not statistically significantly different among PWUD compared with those without a history of drug use. In the 30 days after discharge, there were 3 OPAT complications requiring readmission among patients with a history of drug use and none among patients without drug use. These hospital readmissions were unrelated to patients' vascular access devices.

DISCUSSION

In this analysis of a primarily home-based OPAT program for patients at an urban safety net hospital with high prevalence of substance use, OPAT completion rates were high, both overall and among PWUD. Importantly, readmission rates and adverse events did not differ substantially between PWUD and patients without history of drug use. Our study provides support for including people who use noninjection drugs in OPAT programs, including those that allow patients to receive care in their homes.

Relatively few studies describe IV antibiotic provision at home for vulnerable populations, and to our knowledge, our study is one of the first to describe outcomes of self-administered, home-based IV antibiotics specifically in PWUD. In their comprehensive review, Suzuki et al. reported that home-based OPAT may be the most common delivery method for PWID [4], but this refers to the patients' disposition, not the site at which the antibiotics are actually administered. In many studies of OPAT in PWUD, antibiotics were administered either at an infusion center by a health professional or at home by a visiting health professional, or the antibiotic delivery location was not specified [8–10]. In 1 recent study, home-based OPAT was successful in most of the 21 persons with a history of injection drug use studied [11]. Our study adds to the emerging literature supporting self-administration of antibiotics at home in patients with a history of drug use.

Although most studies of OPAT among PWUD focus on injection drug use, we sought to address outcomes specifically among participants with noninjection drug use, a growing population that includes stimulant use. With the rise of the so-called "fourth wave" of concurrent stimulant and opioid use and the high existing prevalence of stimulant use in the Western United States, evidence is urgently needed to guide optimal OPAT use in this population [12]. One study described OPAT in patients with injection and noninjection drug use, with successful treatment of 5 patients with a noninjection drug use history [13]. In this study, however, these patients (termed "moderate risk") received their antibiotics at an infusion center daily so that vascular access could be monitored, unlike our primarily home-based model.

Our study has certain specific limitations. First, the number of patients in our study was small. As our program transitions from a pilot program to an expanded permanent program, more data will accrue that will hopefully allow for more granular characterization for OPAT success in PWUD (eg, expanded analysis by drug type, etc.) Second, this is a single-center study; as such, generalizability is uncertain, though our detailed drug use and housing demographic could allow for generalizability related to

Table 1. Demographic Characteristics, Clinical Characteristics, and Clinical Outcomes of OPAT Participants, by Drug and Alcohol Use History

	All Antibiotic Treatment Courses (n = 72)	History of Drug or Risky Alcohol Use (n = 35)	No History of Drug or Risky Alcohol Use (n = 37)	*P* Value
Median age (IQR), y	51 (40–60)	50 (43–57)	56 (35–65)	.29
Male sex, % (No.)	69 (50)	86 (30)	54 (20)	.27
Race/ethnicity, % (No.)				
White	28 (20)	40 (14)	16 (6)	.13
Black	18 (13)	14 (5)	22 (8)	.56
Hispanic/Latinx	25 (18)	29 (10)	22 (8)	.79
Asian/Pacific Islander	25 (18)	11 (4)	38 (14)	.06
Other/unknown	4 (3)	6 (2)	3 (1)	1.00
Housing status upon admission, % (No.)				
Housed in apartment/home	85 (61)	65 (26)	95 (35)	.60
Housed in single room occupancy	8 (6)	11 (4)	5 (2)	.68
Homeless[a]	7 (5)	14 (5)	0 (0)	.06
Staying with friends	3 (2)	6 (2)	0 (0)	
In shelter	3 (2)	6 (2)	0 (0)	
Staying outdoors/street	1 (1)	3 (1)	0 (0)	
Comorbid conditions, % (No.)[b]				
Diabetes mellitus	31 (22)	23 (8)	38 (14)	.34
Malignancy	10 (7)	3 (1)	16 (6)	.12
HIV	14 (10)	23 (8)	5 (2)	.09
Other immunosuppression[c]	7 (5)	3 (1)	11 (4)	.36
Drug & alcohol use[b]				
Risky alcohol use or alcohol use disorder	8 (6)	17 (6)	-	
Opioid use disorder on methadone or buprenorphine	7 (5)	14 (5)	-	
Drug use timing				
No history of drug use	58 (42)	14 (5)[d]	100 (37)	
Any drug use	40 (29)	83 (29)		
Recent drug use (<6 mo)	21 (15)	43 (15)	-	
Prior drug use (>6 mo or unspecified)	19 (14)	40 (14)	-	
Unknown drug use	1 (1)	3 (1)[d]	-	
Type of drugs used[b]				
Cocaine	21 (15)	43 (15)	-	
Methamphetamines	21 (15)	43 (15)	-	
Heroin	8 (6)	17 (6)	-	
Other (hallucinogens, benzodiazepines, dissociatives, or not specified)	4 (3)	9 (3)	-	
Infection requiring IV antibiotics[b]				
Bacteremia	31 (22)	31 (11)	30 (11)	1.00
Endocarditis	6 (4)	6 (2)	5 (2)	1.00
Osteomyelitis	21 (15)	20 (7)	22 (8)	.86
Hardware/prosthetic infection	10 (7)	11 (4)	8 (3)	.71
Abscess	13 (9)	14 (5)	11 (4)	.74
Urinary tract infection	10 (7)	9 (3)	11 (4)	1.00
Other[e]	17 (12)	11 (4)	22 (8)	.25
Location of treatment				
Home	72 (52)	60 (21)	84 (31)	.47
Hospital infusion center	21 (15)	31 (11)	11 (4)	.10
Hospital-affiliated skilled nursing facility	6 (4)	6 (2)	5 (2)	1.00
Medical respite facility	1 (1)	3 (1)	0 (0)	.49
Clinical outcomes				
Completion of antibiotic course as outpatient	90 (65)	91 (32)	89 (33)	1.00
30-d hospital readmission	13 (9)	11 (4)	14 (5)	1.00
30-d readmission related to OPAT[f]	4 (3)	9 (3)	0 (0)	.24
90-d hospital readmission	26 (17)	17 (6)	30 (11)	.42
90-d readmission related to OPAT[f]	6 (4)	9 (3)	5 (2)	.68

Abbreviations: IQR, interquartile range; IV, intravenous; OPAT, outpatient parenteral/intravenous antimicrobial therapy.

[a]Patients experiencing homelessness completed OPAT in the following manner: n = 2 at friends' homes, n = 2 at the infusion center, n = 1 at the hospital-affiliated skilled nursing facility.

[b]Categories not mutually exclusive.

[c]Other immunosuppression included solid organ transplant, hematologic malignancy, chemotherapy, or prednisone >10 mg daily.

[d]Individuals using alcohol but not noted to use other drugs.

[e]Other infections included neurosyphilis (n = 4), nontuberculous mycobacterial infections (n = 4), septic arthritis (n = 2), and deep-seated actinomyces infections (n = 2).

[f]OPAT-related readmissions defined as due to antibiotic complication/adverse effect or vascular access device complication.

regional patterns of drug use and other sociodemographic factors. Finally, we relied on medical records for drug use histories; as such, the information could reflect bias, but it reflects real-world chart information used by OPAT providers and home infusion companies to make decisions about patients' candidacy.

In summary, we describe the results of an OPAT program embedded within a safety net hospital system, primarily delivering in-home care to a vulnerable population of patients with high rates of noninjection drug use. We found high completion rates, infrequent readmissions, and similarly strong outcomes for patients with and without drug use history. Self-administered, home-based OPAT should be considered for broader adoption in safety net hospital systems.

Acknowledgments

Financial support. This work was supported by a San Francisco General Hospital Clinical Practice Group program award and National Institutes of Health grant 5T32AI007641-17.

Potential conflicts of interest. Ayesha Appa, none; Carina Marquez, none; Vivek Jain, none. All authors have submitted the ICMJE Form for Disclosure of Potential Conflicts of Interest. Conflicts that the editors consider relevant to the content of the manuscript have been disclosed.

References

1. Wurcel AG, Anderson JE, Chui KK, et al. Increasing infectious endocarditis admissions among young people who inject drugs. Open Forum Infect Dis **2016**; 3:XXX(X):XXX–XX.
2. Fanucchi LC, Walsh SL, Thornton AC, et al. Outpatient parenteral antimicrobial therapy plus buprenorphine for opioid use disorder and severe injection-related infections. Clin Infect Dis **2020**; 70:1226–9.
3. Beieler A, Magaret A, Zhou Y, et al. Outpatient parenteral antimicrobial therapy in vulnerable populations—people who inject drugs and the homeless. J Hosp Med **2019**; 14:105–9.
4. Suzuki J, Johnson J, Montgomery M. Outpatient parenteral antimicrobial therapy among people who inject drugs: a review of the literature. Open Forum Infect Dis **2018**; 5:XXX–XX.
5. Norris AH, Shrestha NK, Allison GM, et al. 2018 Infectious Diseases Society of America clinical practice guideline for the management of outpatient parenteral antimicrobial therapy. Clin Infect Dis **2019**; 68:e1–35.
6. National Institute on Alcohol Abuse and Alcoholism. Alcohol's effects on health: drinking levels defined. Available at: https://www.niaaa.nih.gov/alcohol-health/overview-alcohol-consumption/moderate-binge-drinking. Accessed 14 January 2020.
7. StataCorp. Statistical Software: Release 16. College Station, TX: StataCorp LLC; **2019**.
8. Buehrle DJ, Shields RK, Shah N, et al. Risk factors associated with outpatient parenteral antibiotic therapy program failure among intravenous drug users. Open Forum Infect Dis **2017**; 4:XXX–XX.
9. Papalekas E, Patel N, Reyes KC. OPAT in intravenous drug users (IVDUs): epidemiology and outcomes [abstract 1301]. Open Forum Infect Dis **2014**; 1(Suppl 1):S52–3.
10. Dobson PM, Loewenthal MR, Schneider K, Lai K. Comparing injecting drug users with others receiving outpatient parenteral antibiotic therapy. Open Forum Infect Dis **2017**; 4:XXX–XX.
11. D'Couto HT, Robbins GK, Ard KL, et al. Outcomes according to discharge location for persons who inject drugs receiving outpatient parenteral antimicrobial therapy. Open Forum Infect Dis **2018**; 5:XXX–XX.
12. Enos G. What's old is new again: emergence of stimulants complicates picture. Alcohol Drug Abuse Wkly. **In press**.
13. Camsari UM, Libertin CR. Small-town America's despair: infected substance users needing outpatient parenteral therapy and risk stratification. Cureus **2017**; 9:e1579.