Outpatient Antibiotic Parenteral Therapy in Vulnerable Populations—People Who Inject Drugs and the Homeless

Yuan Zhou

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Committee:

Anna Wald, Chair

Shireesha Dhanireddy

Amalia Magaret

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Abstract

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Yuan Zhou

Chair of the Supervisory Committee:
Anna Wald, MD
Epidemiology

Background: Serious infections that require prolonged parenteral antimicrobial therapy are common among people who inject drugs (PWID) and people who are homeless; and creating an outpatient antibiotic treatment plan can be challenging. We examined patient outcomes of our outpatient parenteral antimicrobial therapy (OPAT) program, with a focus on PWID and the homeless, to evaluate program function and add to the current scarcity of information on the clinical epidemiology and outcomes of bacterial infections in these high-risk populations.

Methods: We conducted a retrospective cohort study of adult patients enrolled in the OPAT program at an urban public hospital. Patients were grouped by injection drug use status and housing status. Baseline demographics, infection types, and clinical outcomes were obtained

from the medical record. Clinical cure was the primary outcome assessed in each patient group. Secondary outcomes included length of hospitalization, secondary bacteremia, line-tampering, and 30-day readmission.

Results: A total of 596 adult patients with 960 diagnosed infections requiring OPAT services were enrolled in the study population. The most common infection diagnosed in PWID was bacteremia. Homeless PWID were more unlikely to achieve clinical cure compared to housed non-PWID patients, when unknown clinical outcomes were included in the analysis (47.2 vs 73.1%; RR 0.6, 95% CI 0.5-0.9, p=0.003). Excluding unknown clinical outcomes, homeless PWID achieve similar rates of clinical cure compared to non-PWID populations (89.3 vs 88.7%, RR 0.95, 95% CI 0.83-1.08; p=0.44). Homeless non-PWID patients achieved similar rates of cure compared to housed non-PWID patients (82.2 vs 73.1%; RR 1.1, 95% CI 0.9-1.3, p=0.12) and had good retention in care.

Conclusion: OPAT and medical respite are effective and successful treatment modalities for many patients, including the homeless. PWID are more likely to be lost to follow-up resulting in uncertain clinical cure rates but when appropriate follow-up is achieved, they have similar rates of clinical cure to non-PWID. Appropriate patient-selection criteria are necessary to optimize clinical outcomes.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

BACKGROUND

Bacterial infections among people who inject drugs (PWID) and people who are homeless are exceedingly common, leading to lengthy hospital stays and complicated treatment strategies. Severe infections such as bacteremia and endocarditis, which disproportionately afflict PWID and the homeless, are difficult to treat and usually require prolonged courses of intravenous (IV) antibiotics.[1-3] Creating appropriate outpatient antibiotic treatment plans for these high-risk populations are particularly challenging, given the current lack of guidance on how to effectively manage such patients after the acute hospitalization period.

Outpatient parenteral antibiotic therapy (OPAT) programs allow patients to safely receive antibiotic therapy at home or other ancillary care settings.[4-7] Little information is known if an OPAT approach may be useful in vulnerable populations, such as PWID and the homeless, because these patients are often excluded from OPAT services.[2,4,7,8] In addition to OPAT, medical respite facilities are harm-reduction care models that can also help reduce the burden of unnecessarily prolonged hospitalizations for patients who are too ill to return to the shelter or streets, but do not require hospital-level care.[1] Medical respite can provide targeted nursing services, such as IV therapy and wound care, in a safe, transitional environment for people who unable to receive traditional OPAT services (i.e. at home or nursing facility). Few hospitals, however, have implemented such programs or assessed their clinical performance.

We evaluated treatment outcomes in PWID and homeless patients enrolled in our OPAT and medical respite programs to add literature on the clinical epidemiology of bacterial infections in these vulnerable populations.

METHODS

We conducted a retrospective cohort study of all hospitalized adult patients who were discharged from Harborview Medical Center (HMC) with outpatient parenteral antibiotic therapy (OPAT) from January 1, 2015 to April 30, 2016. HMC is a level-1, urban, county hospital located in Seattle, Washington, and is affiliated with the University of Washington. Infectious disease specialists supervise our OPAT program and assess patients in follow-up care. Our medical respite facility borders the hospital and is staffed by HMC nurses, mental health specialists, and case managers, who provide clinical care, treat mental illness and substance abuse, and connect patients to primary care and public funding resources.

Patients aged 18 and older were enrolled in OPAT if they were discharged with at least 2 weeks of IV antibiotic therapy or required close (i.e. weekly) laboratory monitoring due to an antibiotic for any diagnosed infection. Patients with multiple hospital encounters were only counted once in our study, under their initial OPAT encounter.

The primary requirement to enter medical respite was homelessness. PWID discharged to respite were instructed not to use their venous line access to inject drugs, but drug abstinence was not otherwise required. A tamper-evident sticker was placed over any accessible venous lines and

nurses monitored patients for line-tampering daily. Patients who violated the line-tampering restriction were discharged from respite and alternative antibiotic plans were created in conjunction with infectious disease clinic providers.

Clinical data collection was performed using REDCap, a data-capturing software program linked to the University of Washington's electronic medical record.[9] Hospitalization dates and basic demographics including age, sex, and race were populated from the electronic medical record. Information on drug use, homelessness, medical comorbidities, type of infection, antibiotic regimen, discharge complications, and follow-up assessment (including clinical cure and loss to follow-up) were reviewed in the medical record and manually entered. Specific medical comorbidities that could potentially affect clinical outcomes, including diabetes mellitus and HIV status, were determined prior to data analysis. Immunocompromised status (listed under medical comorbidity) included chemotherapy treatment, prolonged steroid exposure, organ transplant, use of biologic agents, or any other condition determined by investigators to place patients at increased risk for bacterial infection.

Primary Exposures

The two primary exposures evaluated in this study were current injection drug use (IDU) and homelessness, which were both patient-reported. Current IDU was defined as any IV drug use within 3 months of hospital admission. Homelessness was defined as lack of permanent or stable housing.

Primary Outcome

The primary outcome was clinical cure, defined as completion of appropriate antibiotic therapy and resolution of infection after assessment by a medical provider in follow-up. Patients who died before treatment completion or were placed on oral suppressive antimicrobial therapy were considered not cured. Unknown clinical cure (including medical care transfer and loss to follow-up) were noted separately. Loss to follow-up was assumed if the patient did not return for medical care by the end of the study period, proper transfer of care was not engaged, and no other medical information was learned about their clinical course.

Secondary Outcomes

Secondary outcomes included length of hospital stay, secondary bacteremia, suspected IV line-tampering, and 30-day hospital readmission. Secondary bacteremia was identified if a patient became newly bacteremic during the initial antibiotic treatment course and the bacteremia was not due to the same pathogen as the index illness. Thirty-day readmission data was first noted by readmission for any reason and then further separated by readmission related to the primary OPAT encounter.

Statistical Analysis

Statistical calculations were performed using STATA (v.14). Frequency testing was conducted using chi-squared tests to demonstrate group differences in patient demographics, infection types, and clinical outcomes. Statistical significance was determined with a 2-sided p-value of ≤ 0.05. Mean age, mean infections per encounter, and mean length of hospital stay were

calculated using one-way analysis of variance (ANOVA) to analyze differences among group means.

Primary and secondary outcomes were further evaluated by univariate binomial regression analysis and presented as relative risk ratios with the non-PWID, housed group serving as the baseline comparison. IDU status and homelessness were evaluated independently and as a potential interaction term for patients who met both criteria. Sensitivity analysis of clinical cure was also performed, given the large number of PWID and homeless patients who were lost to follow-up and had unknown clinical outcomes. The sensitivity analysis was conducted using the assumption that all unknown clinical cure outcomes did not achieve clinical cure (i.e. chronic infection or death).

Discharge location was described for all OPAT patients. Sub-analysis of homeless patients was assessed separately, to assess the effect of medical discharge on clinical cure.

Prior to analysis of the current dataset, clinical cure for non-PWID housed patients was estimated to be over 75% while clinical cure rate for PWID or homeless patients was estimated at 50%, representing at least a 25% difference between groups. These estimates were generated based on historical data through our OPAT program. Using a standard 5% alpha error level and 20% beta error level, an estimated number of 45 patients in each group would be necessary to demonstrate a difference of 25% or more in cure rates.

Our study was exempt by the University of Washington's institutional review board because it was a quality improvement project to evaluate our existing OPAT program to improve patient care.

RESULTS

We identified 596 patients who received OPAT services from January 1, 2015 to April 30, 2016. OPAT patients were categorized into four separate groups: Homeless PWID (n=53), housed PWID (n=48), homeless non-PWID (n=45), and housed non-PWID (n=450).

Baseline group demographics are described in Table 1. Age was significantly different among groups ($p<0.001$) and PWID tended to be younger (mean age 40.2 years) than non-PWID (mean age 53.5 years). More patients in the study were men, although the proportion of men in each group was not significantly different (62.3-82.2%, $p=0.05$). Racial composition was statistically different among the study population ($p<0.001$) and patients who identified as white comprised the majority of each group (55.6-83.0%). Prevalence of end-stage renal disease (ESRD) and HIV were not found to be significantly different ($p=0.53$ and $p=0.31$, respectively); however, other comorbidities were statistically significant among groups. Diabetes ($p<0.001$) and immunosuppression ($p=0.04$) were more frequent in non-PWID subgroups hepatitis C infection was more common in PWID ($p<0.001$).

Table 1. Patient demographics of OPAT patients

	Homeless PWID n=53 (%)	Housed PWID n=48	Homeless Non-PWID n=45	Housed Non-PWID n=450	*p-value*
Mean Age (years)	38.8	41.6	49.4	53.9	<0.001
Sex					0.05
Male	33 (62.3)	36 (75.0)	37 (82.2)	290 (64.4)	
Female	20 (37.7)	12 (25.0)	8 (17.8)	160 (35.6)	
Race					<0.001
White	44 (83.0)	38 (79.2)	25 (55.6)	330 (73.3)	
Black	5 (9.4)	6 (12.5)	15 (33.3)	46 (10.2)	
Other[1]	4 (7.6)	4 (8.4)	5 (11.1)	77 (17.1)	
Medical Comorbidities					
ESRD on HD[2]	1 (1.9)	4 (8.3)	2 (4.4)	24 (5.3)	0.53
Diabetes Mellitus	4 (7.6)	4 (8.3)	8 (17.8)	131 (29.1)	<0.001
Immunosuppressed	0	0	0	25 (5.6)	0.04
HIV/AIDS	2 (3.8)	3 (6.3)	1 (2.2)	9 (2.0)	0.31
Hepatitis C	39 (73.6)	32 (66.7)	6 (13.3)	45 (10.0)	<0.001

[1] Other Race includes Asian, Native American/American Indian, Pacific Islander, and Hispanic
[2] Abbreviation: End stage renal disease on hemodialysis

A total of 960 infections requiring OPAT services were diagnosed in the study population (Table 2). There were 111 infections identified in the homeless PWID group, 95 infections in the housed PWID group, 77 infections in the homeless non-PWID group, and 677 infections in the housed non-PWID group. The mean number of infections per person was significantly different among groups (p=0.02): 2.2 infections/person in the homeless PWID, 2.0 infections/person in the housed PWID, 1.8 infections/person in the homeless non-PWID, and 1.5 infections/person in the housed non-PWID.

Table 2. Types of infections in OPAT patients

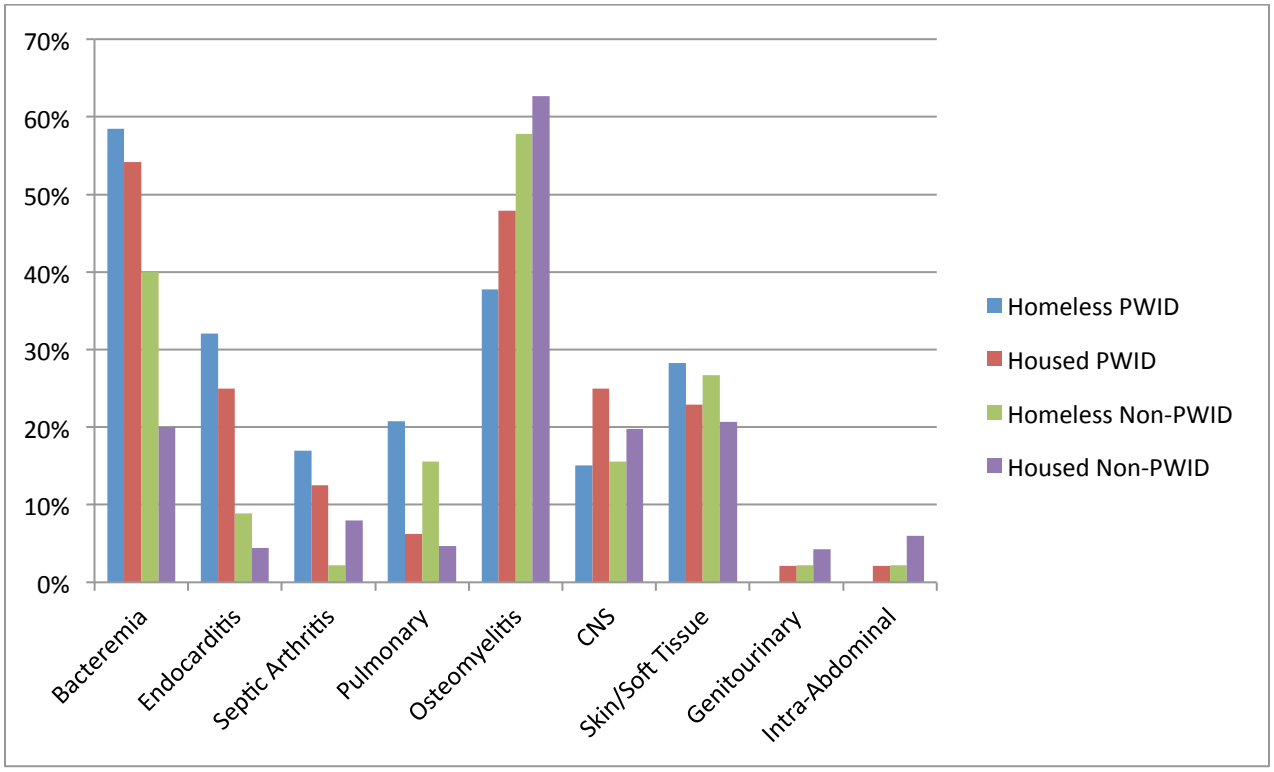
	Homeless PWID n=53 (%)*	Housed PWID n=48	Homeless Non-PWID n=45	Housed Non-PWID n=450	*p-value*
Bacteremia	31 (58.5)	26 (54.2)	18 (40.0)	90 (20.0)	<0.001
Endocarditis	17 (32.1)	12 (25.0)	4 (8.9)	20 (4.4)	<0.001
Septic Arthritis	9 (17.0)	6 (12.5)	1 (2.2)	36 (8.0)	0.04
Pulmonary	11 (20.8)	3 (6.3)	7 (15.6)	21 (4.7)	<0.001
Osteomyelitis	20 (37.7)	23 (47.9)	26 (57.8)	282 (62.7)	0.002
CNS	8 (15.1)	12 (25.0)	7 (15.6)	89 (19.8)	0.56
Skin/Soft Tissue	15 (28.3)	11 (22.9)	12 (26.7)	93 (20.7)	0.52
Genitourinary	0	1 (2.1)	1 (2.2)	19 (4.2)	0.38
Intra-abdominal	0	1 (2.1)	1 (2.2)	27 (6.0)	0.14
Total Infections	111	95	77	677	
Mean Infections per Encounter	2.2	2.0	1.8	1.5	0.02

* Percentage calculations based on persons per group, not total infections per group

Certain infection types were statistically different in frequency among groups including bacteremia ($p<0.001$), endocarditis ($p<0.001$), septic arthritis ($p=0.04$), pulmonary infections ($p<0.001$), and osteomyelitis ($p=0.002$). Bacteremia was most common infection among PWID, including both homeless PWID (58.5%) and housed PWID (54.2%) groups (Figure 1). Endocarditis was more prevalent in PWID groups (25.0-32.1%) than non-PWID groups (4.4-8.9%), as was septic arthritis (12.5-17.0% vs. 2.2-8.0%, respectively). Pulmonary infections were more common among homeless patients (15.6-20.8%) than housed ones (4.7-6.3%). Osteomyelitis was frequently diagnosed in all groups, but highest in the housed non-PWID group (62.7%) and lowest in the homeless PWID group (37.7%). There was no significant difference

among groups in the diagnosis of central nervous system (CNS), skin and soft tissue, genitourinary, or intra-abdominal infections.

Figure 1. Types of infections in OPAT populations, by percentage (%)



Clinical cure rates, among those with a known clinical outcome, were not statistically different by group (p=0.85; Table 3A/B). Every group achieved high rates of clinical cure (88.7-92.7%), if they completed their therapy course and had appropriate follow-up. More PWID, however, had unknown clinical status than non-PWID patients (46.5% vs. 17.0%). Among those with a known outcome, successful clinical cure was not significantly different among homeless PWID (RR 0.95, 95% CI 0.83-1.08; p=0.44), housed PWID (RR 0.98, 95% CI 0.88-1.1; p=0.76), and

Table 3A. Complications and outcomes of OPAT patients

	Homeless PWID n=53 (%)	Housed PWID n=48	Homeless Non-PWID n=45	Housed Non-PWID n=450	*p-value*
Clinical Cure					
Yes	25 (89.3)	24 (92.7)	37 (92.5)	329 (88.7)	0.85
No	3 (10.7)	2 (7.7)	3 (7.5)	42 (11.3)	
*Unknown**	25	22	5	79	
Mean Length of Stay (days)	15.5	21.8	18.2	18.0	<0.001
Secondary Bacteremia	7 (13.2)	2 (4.2)	1 (2.2)	6 (1.3)	<0.001
Line Tampering	19 (35.9)	1 (2.1)	1 (2.2)	3 (0.7)	<0.001
30 Day Readmission	21 (39.6)	10 (20.8)	10 (22.2)	107 (23.8)	0.07
Related to OPAT	14 (26.4)	8 (16.7)	4 (8.9)	59 (13.1)	0.004

* Unknown clinical cure excluded from primary analysis

Table 3B. Univariate binomial regression analysis of OPAT patients

	Homeless PWID	Housed PWID	Homeless Non-PWID	Housed Non-PWID
Clinical Cure				
Yes	0.95 (0.83-1.08) *p=0.44*	0.98 (0.88-1.10) *p=0.76*	1.01 (0.93-1.09) *p=0.82*	Reference
No	---	---	---	---
Unknown	---	---	---	---
Secondary Bacteremia	9.9 (3.5-28.4) *p<0.001*	3.1 (0.6-15.1) *p=0.16*	1.7 (0.2-13.5) *p=0.63*	Reference
Line Tampering	53.8 (16.5-175.7) *p<0.001*	3.1 (0.3-29.5) *p=0.32*	3.3 (0.4-31.4) *p=0.29*	Reference
30 Day Readmission				
Related to OPAT	2.0 (1.2-3.3) *p=0.007*	1.3 (0.6-2.5) *p=0.49*	0.7 (0.3-1.8) *p=0.43*	Reference

homeless non-PWID (RR 1.01, 95% CI 0.93-1.09; p=0.82) compared to housed non-PWID patients.

All secondary outcomes were statistically different among groups including mean length of hospitalization (p<0.001), secondary bacteremia (p<0.001), line tampering (p<0.001), and 30-day readmission related to OPAT (p=0.004). Homeless PWID averaged a shorter length of stay compared to housed PWID (15.5 vs. 21.8 days, respectively). Non-PWID groups averaged 18.2 days for homeless non-PWID and 18.0 days for housed non-PWID. Secondary bacteremia was nearly ten times higher in homeless PWID than housed non-PWID (13.2 vs 1.3%; RR 9.9, 95% CI 3.5-28.4; p<0.001). Suspected central line tampering was also more evident in homeless PWID than housed non-PWID (35.9 vs 0.7%; RR 53.8, 95% CI 16.5-175.7; p<0.001). Homeless PWID were twice as likely to be readmitted than the housed non-PWID group (26.4 vs 13.1%; RR 2.0, 95% CI 1.2-3.3; p<0.001). Secondary bacteremia, suspected line tampering, and 30-day OPAT-related readmission rates in other groups were not significantly different.

The sensitivity analysis of clinical cure (Table 4) demonstrated statistically different cure rates for PWID groups (p<0.001), working under the assumption that those with unknown clinical outcomes resulted in clinical cure failure. Only 47.2% of homeless PWID and 50.0% housed PWID achieved clinical cure compared to non-PWID populations (73.1-82.2%).

Table 4. Sensitivity analysis of clinical cure

	Homeless PWID n=53(%)	Housed PWID n=48	Homeless Non-PWID n=45	Housed Non-PWID n=450	*p-value*
Clinical Cure					<0.001
Yes	25 (47.2)	24 (50.0)	37 (82.2)	329 (73.1)	
*No**	28 (52.8)	24 (50.0)	8 (17.8)	121 (26.9)	

* Assumes all unknown outcomes did not achieve cure

Discharge location varied widely among patients in all groups (p<0.001). The majority of patients with adequate housing (housed PWID 60.4%, housed non-PWID 59.1%) were discharged to home to complete their antibiotic course although a large subset of non-IDU housed non-PWID also went to skilled nursing facilities (36.7%). Among homeless patients, 42.2% of PWID and 58.5% of non-PWID were discharged to respite and few (homeless PWID 15.1%, homeless non-PWID 4.4%) were discharged to a shelter or the street.

Lastly, we analyzed the clinical cure rates of homeless patients discharged to respite (Table 5). Successful clinical cure for homeless patients discharged to respite were not significantly different compared to other homeless patients (58.0% vs. 68.8%, p=0.27). Within the respite population, adjusting for IDU status also did not statistically change cure rates (PWID 48.4%, non-PWID 73.7%, p=0.08). Among all homeless patients (irrespective of discharge location), however, IDU status was a significant risk factor for lack of clinical cure (PWID 47.2%, non-PWID 82.2%, p<0.001), when evaluated under the assumptions of the sensitivity analysis (all unknown clinical cure was considered not cured).

Table 5. Discharge location and impact of medical respite on clinical cure for homeless patients

	Homeless PWID n=53 (%)	Housed PWID n=48	Homeless Non-PWID n=45	Housed Non-PWID n=450	*p-value*
Discharge Location					<0.001
Respite	31 (58.5)	1 (2.1)	19 (42.2)	1 (0.2)	
Home	4 (7.6)	29 (60.4)	10 (22.2)	266 (59.1)	
Inpatient/SNF	6 (9.5)	14 (29.2)	12 (26.7)	165 (36.7)	
Shelter/Street	8 (15.1)	1 (2.1)	2 (4.4)	1 (0.2)	
Other	4 (7.5)	3 (6.3)	2 (4.4)	17 (3.8)	

	D/C Respite PWID n=31 (%)	D/C Respite Non-PWID n=19	Not Respite PWID n=22	Not Respite Non-PWID n=26	*p-value*
Clinical Cure Achieved (All Homeless Patients)	15 (48.4)	14 (73.7)	10 (45.5)	23 (88.5)	0.003

	Discharge Location (All Homeless Patients)	
Cure	Respite	Not Respite
YES	29	33
NO	21	15

p=0.27

	IDU Status (All Homeless Patients)	
Cure	YES	NO
YES	25	37
NO	28	8

p<0.001

	Subgroup of Homeless Patients Discharged to Respite	
Cure	IVDU	No IVDU
YES	15	14
NO	16	5

p=0.08

DISCUSSION

In our study of outpatient parenteral antimicrobial therapy for people who inject drugs and people who are homeless, clinical cure was achieved in less than half of all PWID, when accounting for unknown outcomes. This rate was substantially less than non-PWID groups. When proper follow-up and outcome data were adequately obtained, however, PWID patients achieved similar rates of clinical cure. Homeless non-PWID had similar clinical outcomes compared to housed non-PWID and good rates of follow-up, suggesting that lack of permanent housing is not a significant risk factor for antibiotic treatment failure. Homeless PWID were also at highest risk for loss to follow-up, secondary bacteremia, line-tampering, and 30-day readmission related to OPAT.

To our knowledge, this is the largest study to date of IDU and homeless patients enrolled in an OPAT program.[1,2,7,8] A major benefit of our study is the substantial amount of information collected on the epidemiology and treatment course of infections in these challenging populations. PWID and the homeless are usually difficult to follow due to coexisting psychological illness, substance abuse, transiency, lack of care continuity, ineffective means of communication, and other barriers to care, which is why they are frequently excluded from OPAT programs.[4-8]

In our study, patients were predominantly male and of white race. PWID were generally younger than non-PWID, which may partly explain why diabetes mellitus and immunosuppression were more prevalent in the latter group, as these are diseases that more commonly affect older

populations. Diabetes mellitus and immunosuppression are conditions associated with bacterial infections, and can potentially lead to worse clinical outcomes, but prevalence was low in our PWID groups. Non-PWID groups, who had the highest rates of diabetes mellitus and immunosuppression, also had the best outcomes (when excluding unknown outcomes). The high incidence of hepatitis C virus (HCV) in PWID in our study is consistent with high HCV seroprevalence among PWID, with midpoint estimates of 60% in the United States and 67% globally.[10] Co-infection with HCV, however, does not typically augment treatment options nor lead to treatment failure for other bacterial infections. It is unlikely that any differences in these medical comorbidities played a significant role in outcome differences between groups, and given the small numbers of patients with these comorbidities, we chose to present our results unadjusted. It is possible, though, that clinical cure rates may be even higher in non-PWID groups if adjusted for diabetes mellitus and immunocompromised status.

PWID most commonly were diagnosed with bloodstream infections, including bacteremia and endocarditis, likely as a result from bacterial inoculation during episodes of drug use. Homeless patients were more likely to have respiratory infections, including pneumonia and pulmonary abscesses, which may be related to unstable housing. Pulmonary infections are commonly reported among homeless patients living in shelters, likely because living in groups, crowding, poor sanitation, malnutrition, and periodontal disease predispose homeless patients to infections of the respiratory tract and lungs.[11] The remaining non-PWID housed population were most susceptible to infections associated with post-surgical complications or chronic medical conditions, such as osteomyelitis related to diabetes mellitus.

A significant limitation to our study was the large number of PWID lost to follow-up. Our primary outcome of clinical cure was unable to be ascertained for nearly half of all PWID included in the study. We are unable to determine if these patients ultimately achieved clinical cure and lived, or succumbed to either infection or addiction. PWID with adequate follow-up had clinical cure rates similar to non-PWID populations; however, to assume that patients lost to follow-up achieved clinical cure at comparable rates to patients with known clinical status is probably inaccurate and potentially careless. In a retrospective study of 51 PWID who underwent heart valve replacement surgery for endocarditis, Eddinger et al. found that 25% died within 5 years after discharge, many related to drug use.[3] In a meta-analysis conducted by the World Health Organization on mortality in PWID, pooled standardized mortality ratio showed that PWID were 14.5 more likely to die than the general population per 100 person-years.[12] It is very likely that many PWID in our study did not achieve clinical cure after being lost to follow-up, although we do not have evidence to confirm this.

PWID have traditionally been considered a high-risk group for outpatient management.[4-7] OPAT guidelines from Infectious Disease Society of America (IDSA) state that "patients who are likely to abuse a vascular access system are poor candidates for OPAT".[4] Our results demonstrated that intravenous drug use was significantly associated with unknown, and potentially worse, clinical outcomes; however, to completely restrict PWID from OPAT services may also be unreasonable. In a study by Ho et al., 29 PWID in Singapore were selectively enrolled to receive OPAT services and all but one completed the intended length of antimicrobial therapy. There were no instances of line-tampering, death, or unknown clinical status by the end of the study.[2] This study's success likely reflects much stricter criteria used during the OPAT-patient selection

process. Reflecting on our own OPAT program, we may consider implementing more stringent standards to determine which patients are likely to succeed with OPAT and/or medical respite.

In addition to IDU status, lack of stable housing is often considered a barrier to OPAT.[4,6,8] Medical respite is a true harm-reduction model that our county and hospital implemented to reduce operating costs for patients who require sub-acute care (e.g. IV antibiotics). These patients typically could not complete their treatment outside of the hospital, usually due to drug abuse, homelessness, or lack of insurance. Our medical respite has 34 beds and is limited to patients who are homeless. In this study, approximately half of all homeless patients were discharged to respite to finish their antimicrobial therapy. Homeless patients discharged to respite achieved similar cure rates compared to homeless patients who did not go to respite. While this seems to refute positive effects of medical respite, we aim to clarify the discharge location and other social conditions of these homeless patients. Most homeless patients who did not go to medical respite completed their antimicrobial therapy at home (presumably a relative or friend's house) or inpatient (hospital or skilled nursing facility); a minority of patients was discharged to the street or shelter. In addition, when accounting for IDU status and unknown outcomes, clinical cure rates were higher for homeless non-PWID who went to respite (73.7% vs. 48.4%), although our sample population was not powered to show a statistical difference for this subgroup ($p=0.08$). Thus, medical respite seems to be an effective means of providing specific care for subacute medical conditions and may help reduce the length of hospital stay for patients who would otherwise not be able to leave the hospital to finish their medical treatments.

Very few published studies include or allow PWID or homeless patients to participate in OPAT programs and even fewer hospitals have implemented a medical respite program. We have historical data on OPAT and medical respite outcomes from our own institution with an observational study by Beieler et al. During a 12-month follow-up period from January 2012-2013, 64% (34/53) of patient encounters successfully completed OPAT treatment at medical respite, which is comparable to our current results (58%). Their previous study did not examine specific outcomes for PWID but noted that 53% (28/53) of the study population used IV drugs.[1]

There are several other limitations to our study, which may limit its generalizability to other populations. We are a single-center facility, although Harborview Medical Center shares many similarities to other public hospitals and our findings may apply to safety-net hospitals that care for large numbers of PWID or homeless patients. Our primary exposures of intravenous drug use and housing status were self-reported, which may lead to some patient misclassification, but social conditions are usually verified several times before patients can be discharged with IV antibiotics. Men and people of white race may have been over-represented in our study population, which is not necessary typical for other cities. Lack of follow-up and incomplete ascertainment of clinical outcomes were discussed previously, but may be an inherent challenge due to the multiple comorbidities and transient nature of these challenging patient populations. We elected to present unadjusted risk ratios but certain demographics including various medical comorbidities may affect clinical outcomes. We also did not adjust our regression model for specific infection diagnoses or duration of treatment because we believed that ranking infection types (i.e. endocarditis vs. osteomyelitis) can be subjective and arbitrary. It is possible, though, that particular bacterial infections are more or less likely to be cured. It can also be noted that

our duration of follow-up time for some patients was too short to be able to determine clinical cure, especially for those enrolled towards the end of our study period. The distribution of follow-up time was similar for all patient groups, so we reason that cure rates are likely to reflect long-term endpoints as well.

We conclude that OPAT and medical respite are effective and successful treatment modalities for many patients, including homeless patients. Medical respite may be a cost-effective option for safety-net hospitals caring for large numbers of PWID and homeless patients, although appropriate patient-selection criteria for OPAT and medical respite are necessary in order to optimize clinical outcomes. PWID remain a vulnerable and challenging population to achieve successful outcomes, but is a rich area for quality improvement and development of innovative treatment options. When appropriate medical therapy and follow-up is ascertained in PWID, clinical outcomes are comparable to non-PWID populations. Future studies on this topic may focus on specific interventions among PWID to improve outpatient care coordination and clinical outcomes. Our study provides valuable information and guidance for other public hospitals that serve these vulnerable populations.

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