



# Outcomes of Outpatient Parenteral Antibiotic Treatment of Persons Who Inject Drugs Discharged With Central Venous Access

## Citation

D'Couto, Helen Tressa. 2017. Outcomes of Outpatient Parenteral Antibiotic Treatment of Persons Who Inject Drugs Discharged With Central Venous Access. Doctoral dissertation, Harvard Medical School.

## Permanent link

<http://nrs.harvard.edu/urn-3:HUL.InstRepos:40621398>

## Terms of Use

This article was downloaded from Harvard University's DASH repository, and is made available under the terms and conditions applicable to Other Posted Material, as set forth at <http://nrs.harvard.edu/urn-3:HUL.InstRepos:dash.current.terms-of-use#LAA>

## Share Your Story

The Harvard community has made this article openly available.  
Please share how this access benefits you. [Submit a story](#).

[Accessibility](#)

**Outcomes of Outpatient Parenteral Antibiotic Treatment of Persons Who Inject Drugs Discharged with Central Venous Access**

Helen D'COUTO, BS<sup>1</sup>, Gregory K.ROBBINS<sup>1,2,3</sup>, Kevin ARD<sup>1,2,3</sup>,  
Sarah WAKEMAN<sup>3</sup>, Justin ALVES<sup>2</sup>, Sandra B. NELSON<sup>1,2,3\*</sup>

<sup>1</sup>Harvard Medical School, 25 Shattuck St, Boston, MA, USA; <sup>2</sup>Division of Infectious Diseases, Massachusetts General Hospital, 55 Fruit Street, Boston, MA, USA and <sup>3</sup>Department of Medicine, Massachusetts General Hospital, 55 Fruit Street, Boston, MA, USA

Corresponding Author:

Sandra Bliss Nelson, MD  
Phone: 617-724-0082  
Fax: 617-726-7653  
Email: sbnelson@partners.org

Total word count for manuscript: 2653

Total word count for abstract: 250

Keywords: Persons who inject drugs, outpatient parenteral antimicrobial therapy program, intravenous drug use, substance use disorder

Short Running Title: Persons Who Inject Drugs and Outpatient Central Venous Access

## **Abstract**

**Background:** Opioid use disorder poses an alarmingly significant public health risk. Persons who inject drugs (PWID) suffer from high mortality and morbidity secondary to serious infectious diseases, many of which require prolonged courses of parenteral antibiotics in the outpatient setting. The goal of this study was to determine the outcomes of PWID discharged to home or to a skilled nursing (SNF) or rehabilitation facility with parenteral antibiotic treatment under an outpatient parenteral antimicrobial therapy (OPAT) program.

**Methods:** This is a retrospective observational study. The study population was identified via hospital and OPAT databases. The study population included PWID with known injection drug use in the preceding two years discharged between 2010 and 2015 to home or to a SNF/rehabilitation facility for a planned course of at least two weeks of parenteral antibiotics under the OPAT program. Retrospective chart review was used to describe patient characteristics and outcomes.

**Results:** 52 patients were identified as meeting inclusion criteria, of which 21 were discharged to home and 31 to SNF/rehabilitation. Of the patients discharged to home, 17 (81%) were able to complete their planned antibiotic courses without complication. 20 (64%) of patients discharged to a SNF/rehabilitation facility completed the antibiotic courses without complication. Six (11%) patients had line infections, six patients had injection drug use relapse, and twelve (23%) patients had readmissions.

**Conclusions:** PWID discharged home did not have a significantly higher rate of complications than those discharged to a rehabilitation facility and may be a safe discharge option in carefully selected patients.

## Persons Who Inject Drugs and Outpatient Central Venous Access

### **Student Role**

The immensity of the opioid epidemic was very apparent to me while on my Infectious Diseases rotation at MGH. One of the challenges we consistently faced was how to manage the long antibiotic courses this population often required as a result of infections incurred from intravenous drug use. Upon further reviewing the literature, I realized that there was very data on long-term antibiotic options for PWID. With the advice of Dr. Sandra Nelson, who was my attending on ID, and several other faculty members from ID and addictions medicine, I designed a retrospective review to study the outcomes of PWID who were discharged with central venous access to understand the viability of this as an option for management. I was responsible for study design, data collection, data analysis, and compilation of the manuscript and figures. This is a standalone project though there is discussion of designing a RCT to further study long-term antibiotic management of PWID.

## **Introduction**

Opioid use disorder is an increasingly challenging public health problem. An estimated 24.6 million Americans use illicit drugs.<sup>1</sup> Rates of morbidity and mortality from illicit drug use are also increasing, with deaths from opioid use nearly quadrupling over the previous two decades.<sup>2,3</sup> Infection is a significant cause of morbidity and mortality in people who inject drugs (PWID); skin and soft tissue infections are most common,<sup>4,5</sup> but bacteremia, endocarditis, osteomyelitis, and septic arthritis also occur. These infections are typically treated with prolonged intravenous (IV) antibiotic courses.<sup>6,7</sup> Inpatient admissions for injection drug use-related infections are often two times as expensive as other injection drug-related admissions,<sup>8</sup> and long term parenteral access for this population is challenging given the underlying injection drug use disorder in this population.<sup>9</sup>

Outpatient parenteral antimicrobial therapy (OPAT) programs are increasingly relied upon to facilitate completion of long courses of intravenous antimicrobial therapy outside of the hospital, owing to reduced costs, once daily dosing options, and home infusion technologies.<sup>10,11</sup> OPAT has been shown to be effective in the management of several infectious diseases including endocarditis, soft tissue infections, bacteremia and bone and joint infections.<sup>12–15</sup> Guidelines for the safe administration of OPAT use have been developed; key features include a safe environment, oversight by an infectious diseases physician, reliable communication, and outcomes monitoring.<sup>16</sup> Research on OPAT has focused predominantly on the non-PWID population,<sup>17</sup> and very little is known about the use of OPAT among PWID. As a result of the lack of data to guide the safety of long-term parenteral antibiotics in PWID, the option of completing IV therapy at home is often not considered. Alternative solutions including prolonged inpatient and/or skilled nursing facility stays or oral therapy options may be selected, despite higher costs and the potential for diminished efficacy.<sup>18</sup> There is an urgent need to better understand the risks of outpatient parenteral antimicrobials in PWID. Here we describe the outcomes of a cohort of PWID discharged from the Massachusetts General Hospital (MGH), either to home or to skilled nursing or rehabilitation facilities (SNF/rehabilitation) with OPAT management.

## **Methods**

This was a retrospective observational study to assess the safety and outcomes of PWID discharged to home or a skilled nursing or rehabilitation facility with central venous access for antimicrobial therapy under the MGH OPAT program. The study was conducted at MGH, which serves both a primary care and tertiary referral population in Boston, Massachusetts. The MGH OPAT program manages approximately 800 patients per year. We used the Research Patient Data Registry (RPDR), which is a centralized clinical database registry for Partners Healthcare hospitals, to identify patients admitted to MGH between 1/1/2010 and 12/31/2015 with diagnoses of endocarditis, prosthetic joint infection, septic arthritis, and

## Persons Who Inject Drugs and Outpatient Central Venous Access

osteomyelitis and a concurrent diagnosis of substance use disorder, including but not limited to those having an opioid use disorder. From this list, we identified patients who were followed by the MGH OPAT program. The OPAT program only enrolls patients who require two or more weeks of IV antibiotic therapy after discharge to home, a SNF, or a rehabilitation facility. None of these patients utilized outpatient infusion centers for antibiotic administration. Patients discharged to SNF or rehabilitation facilities were included if they were expected to return to MGH for outpatient follow-up and the OPAT program was assisting with their antibiotic course while at the outside facility. The majority of patients discharged to state-supported rehabilitation facilities, which includes many patients with injection drug use, are followed by Infectious Diseases physicians at these facilities and therefore not enrolled in the MGH OPAT program; these PWID are not included in this study. Diagnosis codes and chart review were then used to identify PWID with known or suspected intravenous drug use in the preceding two years. We defined “recent injection drug use” as known or highly suspected injection drugs (intravenous, intramuscular, or skin popping) in the >1-24 months preceding admission and “ongoing injection drug use” was defined as injection drug use within the month preceding admission.

Data was obtained from the RPDR, electronic medical records (EMR), and OPAT database. Information collected included demographics of ethnicity, age, and sex, index hospitalization, infectious disease diagnosis, and planned antibiotic course. Details on the IDU history and on planned substance use disorder treatment and monitoring after discharge were abstracted from the EMR. When available, information about counseling around discharge planning and family involvement in the substance use disorder plan was also included. Outcome data collected included duration of antimicrobial therapy, line complications (infection, thrombosis), injection drug use relapse, readmission, loss to follow-up, and death.

Descriptive statistics of central tendency were used to analyze patient data. Comparisons between the characteristics of the groups and outcomes of complications between patients discharged to home and discharged to a nursing home or a rehabilitation facility were compared using Fisher’s exact test (two sided, level of significance 0.05).

### **Ethics**

The study protocol was reviewed by the Partners Institutional Review Board. A waiver for informed consent was granted under protocol #2016P000278.

### **Results**

Using the RPDR, 1726 patients were identified with at least one admission during the study period and at least one diagnosis of interest. Of these, 170 patients were also followed by the OPAT program after

## Persons Who Inject Drugs and Outpatient Central Venous Access

discharge. Out of the 170 patients screened from the RPDR and OPAT databases, 52 were identified as meeting inclusion criteria; 21 were discharged home to complete parenteral antibiotics and 31 were discharged to a skilled nursing or rehabilitation facility (Figure 1). Of the 118 patients excluded, 109(92%) did not have a documented history (known or suspected) of injection drug use in the 24 months preceding admission. Three (2%) patients had OPAT courses that were outside of our study period. Additionally, seven (6%) patients were discharged without an intravenous line. The majority of patients were white (50, 96%) (Table 1). There were 16 females (31%). The median age was 33 (range 23-61). Of the patients discharged home, there were 18 (86%) patients with a history of opioid IDU, 2 (9%) with a history of opioid and cocaine IDU, and 1 (5%) patient with a history of cocaine IDU. Of those discharged to SNF/rehabilitation, there was a higher rate of cocaine use (14, 45%). All patients had a history of injection drug use within the prior two years. However, patients discharged to rehabilitation had a higher rate of ongoing injection drug use than of those discharged home (21, 68% versus 7, 33%,  $p < 0.05$ ).

The median duration of hospital admission was 11 days (range 3-60 days). Of all patients included, 13(25%) patients had a diagnosis of endocarditis, 19 (36%) of osteomyelitis, 2 (4%) of prosthetic joint infection, 14 (27%) of septic arthritis, 1 (2%) had endocarditis and septic arthritis, 1 (2%) had an empyema, and 2 (4%) had other infections, bacteremia, or spinal hardware infection, requiring parenteral antibiotics (Table 1). Additionally, thirteen patients also had additional diagnoses, including concomitant bacteremia, epidural abscess, psoas abscess, mediastinal abscess, lung abscess, intracerebral abscess, or a below-knee amputation stump infection. MSSA was the most common organism treated (28, 54%), followed by MRSA (9, 17%). Other organisms included other Gram-positive (GP) (14, 27%), Gram-negative (GN) (6, 11%), and fungal (1, 2%) species. The most common intravenous antibiotics were cephalosporins (24, 46%), penicillins (19, 37%), vancomycin (10, 19%), daptomycin (6, 11%), and fluoroquinolones (1, 2%).

Planning for discharge with intravenous access was reviewed for potential factors that may predict success of an OPAT course. Overall, patients discharged to home had more documented substance use disorder discharge planning than those discharged to SNF/rehabilitation. Twelve (57%) PWID discharged home versus 5 (16%) discharged to SNF/rehabilitation received substance use disorder treatment ( $p < 0.05$ ). Twenty (95%) discharged home received counseling on the risks of discharge with an intravenous catheter, versus 13 (42%) of those discharged to SNF/rehabilitation ( $p < 0.05$ ). Eight (38%) discharged home had family involvement in the substance use and discharge plans, versus 5 (16%) discharged to SNF/rehabilitation ( $p > 0.05$ ). Five (24%) patients discharged to home versus two (6%) patients discharged to rehabilitation had routine toxicology monitoring while on OPAT ( $p > 0.05$ ).

## Persons Who Inject Drugs and Outpatient Central Venous Access

Seventeen (81%) of the patients discharged home were able to complete the planned OPAT course and had no known complications from injection drug use (Table 2, Table 4). We were particularly interested in the circumstances of those four (19%) patients discharged to home who had complications. One patient, a male (age 20-30), being treated for MSSA endocarditis developed a line infection due to *Bacillus*, which was attributed to documented injection drug relapse. His line was removed and he completed his antimicrobial course with oral linezolid. He had last used injection opioids four months prior to admission and was discharged on methadone and with plans for addiction counseling. The second patient was a male (age 30-40) admitted for vertebral osteomyelitis due to *Pseudomonas aeruginosa* who was being treated with cefepime for a planned 8-week course. He was lost to follow-up after the first OPAT appointment in the seventh week. Unsuccessful attempts were made through law enforcement to find the patient in order to pull the PICC line. The third patient passed away the day after discharge from cardiac arrest thought to be due to thromboembolic disease from bacterial endocarditis; he had a negative toxicology screen and injection drug relapse was not suspected. A fourth patient required readmission to complete parenteral antibiotics due to unanticipated homelessness.

Of the patients discharged to SNF/rehabilitation, 11 (35%) of the 31 patients had complications during the planned OPAT course. Five (16%) patients had line complications (all line infections), of whom three had documented injection drug relapse. In total, five (16%) had documented injection drug re-use. Four (13%) were lost to follow-up. Nine (29%) patients had readmissions during their OPAT course, one of which was due to an antibiotic complication unrelated to injection drug use (Table 3, Table 4).

Patients who were discharged home did not have a significantly higher rate of complications compared with patients discharged to a facility 4 (19%) versus 11 (35%),  $p > 0.05$  (Table 5). One (5%) patient discharged to home had a line infection compared to five (16%) discharged to a rehabilitation facility ( $p > 0.05$ ). Rates of injection drug relapse between patients discharged to home versus to rehab were also not significantly different (1, 5%, versus 5, 16%,  $p > 0.05$ ). One (5%) patient was lost to follow-up in the discharged to home group compared to four (13%) patients in the discharged to rehabilitation group ( $p > 0.05$ ). Overall rates of readmission among patients discharged to home compared to patients discharged to rehabilitation were not different (3, 14%, versus 9, 29%,  $p > 0.05$ ).

### Discussion

This retrospective review provides an important clinical experience of a cohort of PWID discharged from the hospital on OPAT. Given the worsening injection drug use and opioid crisis,<sup>19</sup> this population represents a growing proportion of patients requiring long term parenteral antibiotics for increasingly complex infections.<sup>6</sup> In this cohort of patients discharged to home or to a SNF/rehabilitation facility a majority of patients were able to safely complete their OPAT courses. Of the four patients discharged to



## Persons Who Inject Drugs and Outpatient Central Venous Access

home who had complications during the course of OPAT, two had complications attributed to injection drug use. Of note, neither of these patients had family who were involved in planning their discharge. Engaging families in OPAT planning has been noted to be an important factor in selecting successful OPAT candidates.<sup>13</sup> The group of patients discharged home on OPAT did not have a significantly higher rate of complications, including rates of injection drug relapse, readmission, line complication, and follow-up, compared to those who were discharged to a rehabilitation facility. This suggests that for carefully selected patients the home environment could be a safe and lower cost alternative to prolonged inpatient admissions or rehabilitation stays, which carry their own risks. Acknowledging these groups are not identical at baseline, future randomized studies should be done to better compare outcomes.

Addressing the opioid crisis itself is crucial to controlling the rate of infections as a result of injection drug use. Methods of illicit drug use including skin popping and use of unclean needles are contributing to the incidence of infections and are being addressed through counseling and public health initiatives such as safe needle exchanges.<sup>20,21</sup> However, there is a clear and immediate need for management strategies of infections incurred among the PWID population. Integration of addiction care in the treatment of PWID with injection drug use-associated infections is important in reducing complications. For example, patients being treated for endocarditis associated with injection drug use were found to have low rates of addiction counseling or treatment.<sup>22</sup> Similarly, we found an overall low rate of addiction counseling in our patients being treated for infections. Interestingly, while more patients discharged to rehabilitation had ongoing injection drug use at the time of admission, fewer of these patients were receiving substance use disorder treatment at the time of discharge (addiction counseling and/or medication).

Several guidelines have been proposed for identifying patients in general who are safe candidates for OPAT but none have been developed which specifically address PWID. Available guidelines include necessity for intravenous antibiotics, medically stable patients, clear understanding of the OPAT plan, ease of transportation and communication, and usually no substance use disorder.<sup>23,24</sup> Based on our experience, we propose a few additional considerations for safe OPAT at home for PWID: engagement in addiction care, strong consideration for initiation of pharmacotherapy during the inpatient admission,<sup>25,26</sup> a reliable support network of family or friends who understand the treatment plan and are aware of the patient's substance use disorder, patient confirmation of understanding of the risks of having an intravenous line and agreement with the plan, consultation with outpatient addiction providers if applicable, and prior evidence of abstinence from injection drug use (Table 6). One study in Singapore prospectively studied the implementation of pre-determined selection criteria for OPAT among PWID in need of parenteral antibiotic therapy and found similar rates of successful completion of OPAT as in our cohort. In their study, patients presented daily to an infusion center for IV antibiotics and had a tamper-

## Persons Who Inject Drugs and Outpatient Central Venous Access

seal over the peripherally inserted central catheter which was used to monitor for tampering of the line, and they proposed this as an additional intervention to increase the likelihood of success.<sup>27</sup> Such an approach may be appropriate for patients who have access to daily infusion services.

Our study had several important limitations. First, the small sample size limited our ability to analyze the data. The majority of patients with injection drug use in need of IV antimicrobial therapy after discharge are not discharged home. Furthermore, many PWID were discharged to SNF/rehabilitation facilities with internal OPAT oversight and thus were not monitored by the MGH OPAT program. While we compared patients discharged to home to those discharged to a rehabilitation facility it is important to note that these were not matched cohorts and were not equivalent at baseline. Patients who were perceived to be higher risk for injection drug relapse or medication non-adherence would have been more likely to be discharged to a rehabilitation facility. Additionally, patients with more severe or complex infections and significant co-morbidities are also more likely to have been discharged to a rehabilitation facility. As such direct comparisons between the two groups are not necessarily valid. More data and or prospective studies are needed to evaluate the safety and efficacy of OPAT for PWID as well as the utility of specific interventions prior to discharge.

In conclusion, amidst the growing opioid and injection drug use epidemic, outpatient treatment options for long-term antibiotic therapy are desperately needed. This retrospective study of a single large tertiary hospital shows that the majority of PWID needing long-term antibiotics and deemed safe for discharge from the hospital to home or to SNF/rehab for OPAT by their primary medical team were able to safely complete their parenteral antibiotic course. Discharge planning that includes counseling and treatment for substance use disorder and involves family members may increase success. Further studies are needed to develop a screening tool to identify PWID who can safely be sent home on OPAT.

### **Funding**

This study was supported by internal funding.

### **Transparency**

The authors have no conflicts of interest to declare.

## References

1. *Results from the 2013 National Survey on Drug Use and Health: Summary of National Findings*. Rockville, MD; 2014.  
<http://www.samhsa.gov/data/sites/default/files/NSDUHresultsPDFWHTML2013/Web/NSDUHresults2013.pdf>.
2. Rudd RA, Paulozzi LJ, Bauer MJ, *et al*. Increases in heroin overdose deaths - 28 States, 2010 to 2012. *MMWR Morb Mortal Wkly Rep*. 2014;**63**:849-854.  
<http://www.ncbi.nlm.nih.gov/pubmed/25275328>.
3. Trecki J, Gerona RR, Schwartz MD. Synthetic Cannabinoid–Related Illnesses and Deaths. *N Engl J Med*. 2015;**373**:103-107. doi:10.1056/NEJMp1505328.
4. Bassetti S, Hoffmann M, Bucher HC, *et al*. Infections Requiring Hospitalization of Injection Drug Users Who Participated in an Injection Opiate Maintenance Program. *Clin Infect Dis*. 2002;**34**:711-713. doi:10.1086/338876.
5. Binswanger IA, Kral AH, Bluthenthal RN, *et al*. High prevalence of abscesses and cellulitis among community-recruited injection drug users in San Francisco. *Clin Infect Dis*. 2000;**30**:579-581. doi:10.1086/313703.
6. Gordon RJ, Lowy FD. Bacterial Infections in Drug Users. *N Engl J Med*. 2005;**353**:1945-1954. doi:10.1056/NEJMra042823.
7. Scheidegger C, Zimmerli W. Infectious complications in drug addicts: seven-year review of 269 hospitalized narcotics abusers in Switzerland. *Rev Infect Dis*. **11**:486-493.  
<http://www.ncbi.nlm.nih.gov/pubmed/2749105>.
8. Stein MD, Sobota M. Injection drug users: hospital care and charges. *Drug Alcohol Depend*. 2001;**64**:117-120. <http://www.ncbi.nlm.nih.gov/pubmed/11470348>.
9. Kim JB, Ejiofor JI, Yammine M, *et al*. Surgical outcomes of infective endocarditis among intravenous drug users. *J Thorac Cardiovasc Surg*. 2016;**152**:832-841.e1. doi:10.1016/j.jtcvs.2016.02.072.
10. Chary A, Tice AD, Martinelli LP, *et al*. Experience of infectious diseases consultants with outpatient parenteral antimicrobial therapy: results of an emerging infections network survey. *Clin Infect Dis*. 2006;**43**:1290-1295. doi:10.1086/508456.
11. Tice A. Outpatient parenteral antimicrobial therapy as an alternative to hospitalization. *Int J Clin Pract Suppl*. 1998;**95**:4-8. <http://www.ncbi.nlm.nih.gov/pubmed/9796549>.
12. Rehm S, Champion M, Katz DE, *et al*. Community-based outpatient parenteral antimicrobial therapy (CoPAT) for *Staphylococcus aureus* bacteraemia with or without infective endocarditis: analysis of the randomized trial comparing daptomycin with standard therapy. *J Antimicrob Chemother*. 2009;**63**:1034-1042. doi:10.1093/jac/dkp051.
13. Andrews M, von Reyn CF. Patient Selection Criteria and Management Guidelines for Outpatient

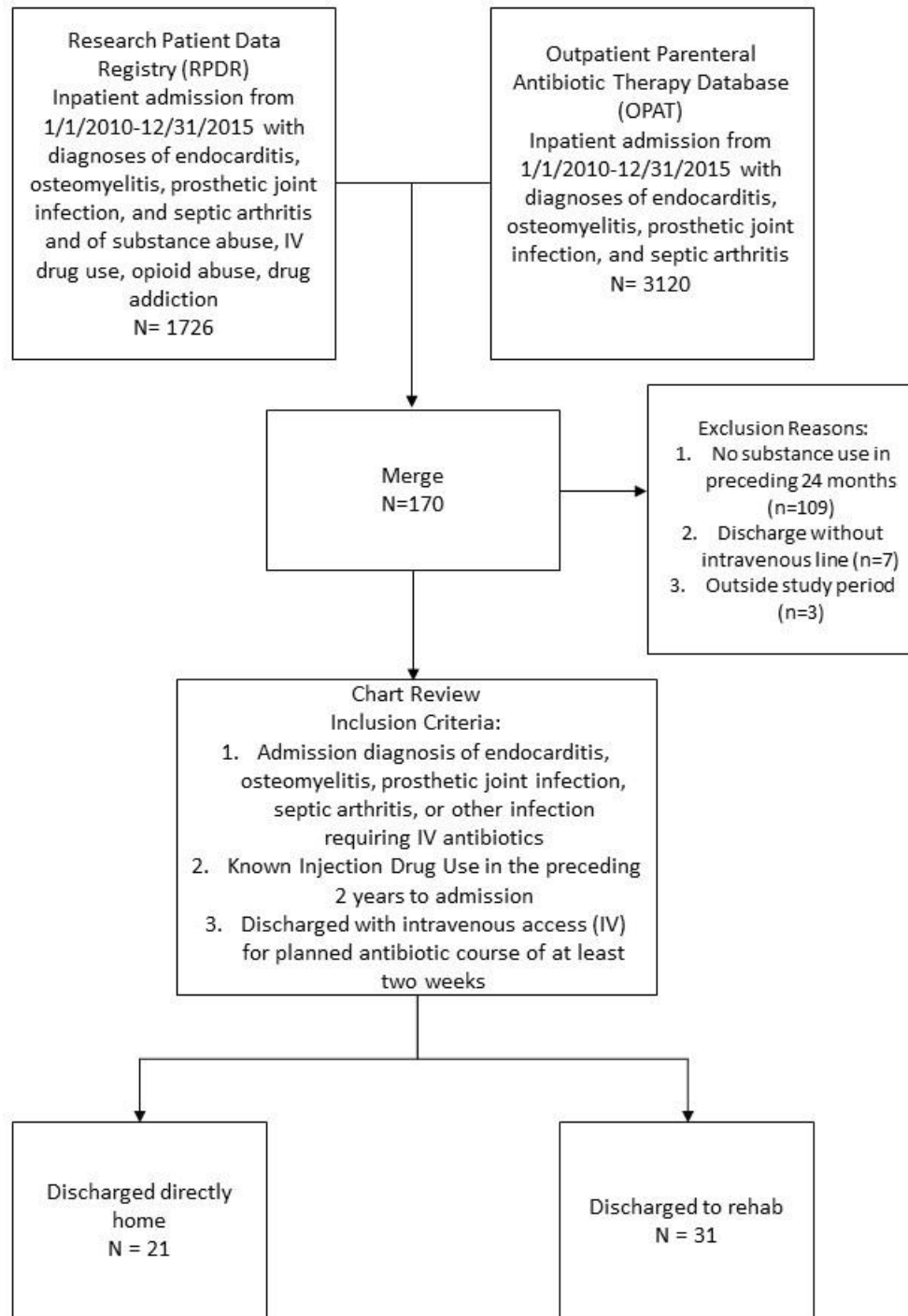
## Persons Who Inject Drugs and Outpatient Central Venous Access

- Parenteral Antibiotic Therapy for Native Valve Infective Endocarditis. *Clin Infect Dis*. 2001;**33**:203-209. doi:10.1086/321814.
14. Mackintosh CL, White HA, Seaton RA. Outpatient parenteral antibiotic therapy (OPAT) for bone and joint infections: experience from a UK teaching hospital-based service. *J Antimicrob Chemother*. 2011;**66**:408-415. doi:10.1093/jac/dkq445.
  15. Muldoon EG, Switkowski K, Tice A, *et al*. A national survey of infectious disease practitioners on their use of outpatient parenteral antimicrobial therapy (OPAT). *Infect Dis (London, England)*. 2015;**47**:39-45. doi:10.3109/00365548.2014.967290.
  16. Tice AD, Rehm SJ, Dalovisio JR, *et al*. Practice Guidelines for Outpatient Parenteral Antimicrobial Therapy. *Clin Infect Dis*. 2004;**38**:1651-1671. doi:10.1086/420939.
  17. Matthews PC, Conlon CP, Berendt AR, *et al*. Outpatient parenteral antimicrobial therapy (OPAT): is it safe for selected patients to self-administer at home? A retrospective analysis of a large cohort over 13 years. *J Antimicrob Chemother*. 2007;**60**:356-362. doi:10.1093/jac/dkm210.
  18. Mertz D, Viktorin N, Wolbers M, *et al*. Appropriateness of antibiotic treatment in intravenous drug users, a retrospective analysis. *BMC Infect Dis*. 2008;**8**:42. doi:10.1186/1471-2334-8-42.
  19. Dart RC, Surratt HL, Cicero TJ, *et al*. Trends in Opioid Analgesic Abuse and Mortality in the United States. *N Engl J Med*. 2015;**372**:241-248. doi:10.1056/NEJMsa1406143.
  20. Schuckit MA. Treatment of Opioid-Use Disorders. Longo DL, ed. *N Engl J Med*. 2016;**375**(4):357-368. doi:10.1056/NEJMra1604339.
  21. Sawangjit R, Khan TM, Chaiyakunapruk N. Effectiveness of Pharmacy-Based Needle/Syringe Exchange Program for People Who Inject Drugs: A Systematic Review and Meta-analysis. *Addiction*.**112**:236-247. doi:10.1111/add.13593.
  22. Rosenthal ES, Karchmer AW, Theisen-Toupal J, *et al*. Suboptimal Addiction Interventions for Patients Hospitalized with Injection Drug Use-Associated Infective Endocarditis. *Am J Med*. 2016;**129**:481-485. doi:10.1016/j.amjmed.2015.09.024.
  23. Seaton RA, Barr DA. Outpatient parenteral antibiotic therapy: Principles and practice. *Eur J Intern Med*. 2013;**24**:617-623. doi:10.1016/j.ejim.2013.03.014.
  24. Marculescu CE, Berbari EF, Cantey JR, *et al*. Practical considerations in the use of outpatient antimicrobial therapy for musculoskeletal infections. *Mayo Clin Proc*. 2012;**87**:98-105. doi:10.1016/j.mayocp.2011.11.005.
  25. Shanahan CW, Beers D, Alford DP, *et al*. A transitional opioid program to engage hospitalized drug users. *J Gen Intern Med*. 2010;**25**:803-808. doi:10.1007/s11606-010-1311-3.
  26. Kushel M. Improving care for hospitalized, opioid-dependent patients: a promising start. *JAMA Intern Med*. 2014;**174**:1377-1378. doi:10.1001/jamainternmed.2014.728.
  27. Ho J, Archuleta S, Sulaiman Z, *et al*. Safe and successful treatment of intravenous drug users with a peripherally inserted central catheter in an outpatient parenteral antibiotic treatment service. *J*

Persons Who Inject Drugs and Outpatient Central Venous Access

*Antimicrob Chemother.* 2010;**65**:2641-2644. doi:10.1093/jac/dkq355.

## Persons Who Inject Drugs and Outpatient Central Venous Access



**Figure 1.** Selection criteria and process for study patients.

Persons Who Inject Drugs and Outpatient Central Venous Access

**Table 1. Characteristics of Patients Discharged to Home and Rehab**

	Discharged to Home (n=21)	Discharged to Rehab (n=31)	p - value (Fisher's Exact Test)
<b>Demographics</b>			
<b>Gender</b>			
Female	6 (29%)	10 (32%)	
Male	15 (71%)	21 (68%)	
<b>Ethnicity</b>			
Black	1 (5%)	0	
Hispanic	0	0	
Asian	0	0	
White	20 (95%)	30 (97%)	
Other/Unknown	0	1 (3%)	
<b>Age</b>			
(Median, Range)	30 (23-51)	33(24-61)	
<b>Injection Drug History</b>			
Ongoing	7 (33%)	21 (68%)	0.01
Within 24 mo.	14 (67%)	10 (32%)	
Opioids	20 (95%)	28 (90%)	
Cocaine	3 (14%)	14 (45%)	
<b>Admission Information</b>			
<b>Diagnosis</b>			
Endocarditis	8 (38%)	6 (19%)	
Osteomyelitis	6 (29%)	13 (42%)	
Prosthetic Joint Infection	1 (5%)	1 (3%)	
Septic Arthritis	5 (24%)	10 (32%)	
Other	3 (14%)	14 (45%)	
<b>Pathogen</b>			
MRSA	3 (14%)	6 (19%)	
MSSA	12 (57%)	16 (52%)	
Other GP	6 (29%)	8 (26%)	
Other GN	2 (10%)	4 (13%)	
Fungal	1 (5%)	0	
<b>Treatment</b>			
Penicillins	11 (52%)	8 (26%)	
Vancomycin	3 (14%)	7 (23%)	
Cephalosporins	7 (33%)	17 (55%)	
Daptomycin	3 (14%)	3 (10%)	
Fluoroquinolones	0	1 (3%)	
Carbapenems	0	1 (3%)	
<b>Substance Abuse</b>			
<b>Treatment</b>	12(57%)	5(16%)	<0.05
Medication	9(43%)	5(16%)	0.06
Counseling	9(43%)	3(10%)	0.01
Toxicology Monitoring	5(24%)	2(6%)	0.10
IV risk counseling	20(95%)	13(42%)	<0.01
Family involvement	8(38%)	5(16%)	0.11

**Table 2. Characteristics of PWID Discharged to Home**

Patient	Demographics				IDU History			Admission Information					
	Gender	Age	Ethnicity	Duration of Use	Injection Drug	Diagnosis	Organism	Antibiotics	Substance Abuse Treatment	Toxicology Monitoring	IV Risk Counseling	Family Involvement	
1	M	30-40	White	Ongoing	Opioids	Right-sided Endocarditis	GP	PCNs	Counseling	Yes	Yes	No	
2	M	30-40	White	Ongoing	Opioids	Endocarditis	GP	PCNs	Medication, Counseling	Yes	Yes	Yes	
3	M	20-30	White	Ongoing	Opioids	Spinal hardware osteomyelitis	MSSA	Cephalosporins	Medication	No	Yes	No	
4	M	20-30	White	Ongoing	Opioids, Cocaine	Osteomyelitis	MSSA	PCNs, Cephalosporins	Medication, Counseling	Yes	Yes	Yes	
5	F	20-30	White	Within 2 yrs	Opioids	Right-sided endocarditis	MSSA	PCNs	No	No	Yes	Yes	
6	M	20-30	White	Within 2 yrs	Opioids	Right-sided Endocarditis	MSSA	PCNs	Medication, Counseling	No	Yes	No	
7	M	20-30	White	Ongoing	Opioids	Endocarditis, septic arthritis	MSSA	Vancomycin	No	No	Yes	Yes	
8	F	20-30	White	Ongoing	Opioids	Right-sided Endocarditis	MSSA	PCNs	Medication, Counseling	Yes	Yes	Yes	
9	M	20-30	White	Within 2 yrs	Opioids	Left-sided Endocarditis	GP	PCNs	No	No	Yes	No	
10	M	30-40	White	Within 2 yrs	Opioids	Septic arthritis	MRSA	Daptomycin	Medication	No	Yes	No	
11	F	50-60	White	Within 2 yrs	Opioids, Cocaine	Osteomyelitis	MRSA	Vancomycin, Cephalosporins	Medication	Yes	Yes	No	
12	M	30-40	White	Within 2 yrs	Opioids	Osteomyelitis	GN	Cephalosporin	Medication, Counseling	No	Yes	No	
13	M	40-50	White	Within 2 yrs	Opioids	Osteomyelitis	MSSA	Cephalosporins	No	No	Yes	No	
14	M	30-40	White	Within 2 yrs	Cocaine	Osteomyelitis	MSSA, GP, GN	PCNs	No	No	Yes	No	
15	M	50-60	White	Within 2 yrs	Opioids	PII	MRSA	Daptomycin	Medication, Counseling	No	Yes	No	
16	F	50-60	White	Within 2 yrs	Opioids	Septic arthritis	MSSA	Cephalosporins	No	No	Yes	No	
17	F	40-50	White	Within 2 yrs	Opioids	Osteomyelitis	MSSA	Daptomycin	Counseling	No	Yes	Yes	
18	M	20-30	White	Within 2 yrs	Opioids	Septic arthritis	MSSA	PCNs	No	No	Yes	No	
19	F	30-40	Black	Within 2 yrs	Opioids	Septic arthritis	MSSA	Cephalosporins	No	No	Yes	Yes	
20	M	20-30	White	Ongoing	Opioids	Bacteremia of unknown source	GP	PCNs	Counseling	No	Yes	Yes	
21	M	30-40	White	Within 2 yrs	Opioids	Endocarditis	GP, fungal	PCN,	No	No	Yes	No	

PWID, Persons Who Inject Drugs; IDU, Injection Drug Use; F, Female; M, Males PCN, penicillin; GP, Gram Positive; GN, Gram Negative; IV, intravenous;



Persons Who Inject Drugs and Outpatient Central Venous Access

**Table 3. Characteristics of PWID Discharged to SNF/Rehab with Complications**

Patient	Demographics			IDU History		Admission Information									
	Gender	Age	Ethnicity	Duration of Use	Injection Drug	HIV	HCV	HBV	Diagnosis	Organism	Antibiotics	Substance Abuse Treatment	Toxicology Monitoring	IV Risk Counseling	Family Involvement
1	M	50-60	White	Ongoing	Opioids	No	Yes	No	Septic arthritis	MSSA	Cephalosporins	No	No	Yes	No
2	M	40-50	White	Ongoing	Opioids	No	Yes	No	Osteomyelitis	MSSA	PCNs	No	No	No	No
3	M	30-40	White	Ongoing	Opioids, Cocaine	No	Yes	Yes	Septic arthritis	MSSA	Cephalosporins	Medication, Counseling	No	No	No
4	M	50-60	White	Within 2 years	Opioids, Cocaine	No	Yes	No	Osteomyelitis	MRSA, GP, GN	Cephalosporins, Daptomycin	No	No	No	No
5	M	40-50	White	Within 2 years	Opioids	No	Yes	No	Septic arthritis	MSSA	Vancomycin, Cephalosporins	No	No	Yes	No
6	M	60-70	White	Within 2 years	Opioids, Cocaine	No	Yes	No	PJI	GP	Vancomycin	Medication	No	No	No
7	F	20-30	White	Within 2 years	Opioids, Cocaine	No	Yes	No	Right-sided Endocarditis	GP	PCNs	Medication, Counseling	No	Yes	No
8	M	30-40	White	Ongoing	Opioids, Cocaine	No	Yes	No	Septic arthritis	MRSA	Vancomycin	No	No	No	No
9	M	30-40	White	Within 2 years	Opioids	No	Yes	Yes	Osteomyelitis	GP	PCNs, Vancomycin	No	No	No	No
10	M	60-70	White	Within 2 years	Opioids, Cocaine	No	Yes	No	Septic arthritis	MRSA, GP	Vancomycin	No	No	No	No
11	F	20-30	White	Ongoing	Cocaine	No	Yes	No	Left-sided Endocarditis	MSSA	PCNs	No	No	No	No

PWID, Persons Who Inject Drugs; F, Female; M, Male; GP, Gram Positive; GN, Gram Negative; PCN, penicillin PJI, Prosthetic Joint Infection; IV, intravenous; IDU, injection drug use

Persons Who Inject Drugs and Outpatient Central Venous Access

**Table 4. Complications of PWID to Home and to SNF/Rehab**

Patient	Discharged to Home				Discharged to SNF/Rehab				Other
	Line Complication	IDU Re-use	Loss to follow-up	Readmission	Line Complication	IDU Re-use	Loss to follow-up	Readmission	
1	N/A	N/A	N/A	N/A	No	Yes	Yes	No	
2	No	No	No	No	Infection- Pseudomonas	Yes	Yes	Yes	Pulmonary Septic Emboli
3	No	No	No	No	Infection- polymicrobial	Yes	No	Yes	
4	No	No	No	No	Infection- polymicrobial	No	No	Yes	
5	No	No	No	No	No	No	No	No	Left rehab, switch to PO
6	Infection	Yes	No	Yes	Infection- Klebsiella	Yes	No	Yes	Klebsiella bacteremia, Fungal hematoma
7	No	No	No	No	Infection- MRSA	No	No	Yes	
8	No	No	No	No	No	Yes	Yes	Yes	Pulmonary septic emboli
9	No	No	No	No	No	No	Yes	Yes	
10	No	No	No	No	No	No	No	Yes	
11	No	No	No	No	No	No	No	Yes	Small bowel septic emboli
12	No	Unknown	Yes	Yes					
13	No	No	No	No	No	No	No	No	
14	No	No	No	No	No	No	No	No	
15	No	No	No	No	No	No	No	No	
16	No	No	No	No	No	No	No	No	
17	No	No	No	No	No	No	No	No	
18	No	No	No	No	No	No	No	No	
19	No	No	No	No	No	No	No	No	
20	No	No	No	No	No	No	No	No	
21	No	No	No	No	No	No	No	No	

PWID, Persons Who Inject Drugs; IDU, Injection Drug Use; F, Female; M, Males; GP, Gram Positive; GN, Gram Negative; IV, intravenous;

**Table 5. Outcomes of Patients Discharged to Home v Rehab**

	Discharged to Home (n=21)	Discharged to Rehab (n=31)	p-value (Fisher's Exact Test)
Any Complication	4	11	0.23
Line Complications	1	5	0.38
Injection Drug Use	1	5	0.38
Relapse	1	5	0.38
Loss to Follow-up	1	4	0.64
Readmission	3	9	0.72
Death	1	0	0.40

**Table 6. Proposed Considerations for the Use of OPAT in PWID**

- Engagement in addiction care
- Consideration of pharmacotherapy during admission
- Reliable support network of family or friends
- Patient understanding of intravenous line risks
- Outpatient addiction provider consult
- Prior abstinence from injection drug use

---

OPAT, Outpatient Parenteral Antimicrobial Therapy; PWID, Persons Who Inject Drugs;