



# Outcomes of patients with a history of injecting drug use and receipt of outpatient antimicrobial therapy

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Received: 8 August 2018 / Accepted: 20 December 2018 / Published online: 24 January 2019  
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## Abstract

People who inject drugs (PWID) are susceptible to endovascular and deep-seated infections which require prolonged antibiotic therapy. There are concerns regarding this cohort's suitability for outpatient parenteral antimicrobial therapy (OPAT), but relatively little published data. Our aim is to publish our outcomes in this setting, to inform other clinicians' decisions regarding PWID in OPAT. We reviewed case records of all PWID in our OPAT service from July 2015 to December 2017. Successful completion of OPAT care was defined as completing the duration of parenteral therapy as planned at the outset, with expected clinical improvement. Data was collected on complications including hospital re-admission, new blood stream infections, patient non-compliance including ongoing non-prescribed intravenous drug use, and staff safety compromise. Twenty-eight of 38 (76.2%) episodes of OPAT care for PWID were completed successfully, with 724 bed days of care provided. The cohort was labour intensive to manage with high rates of re-admission, non-attendance and line-associated infections. There were no adverse events for staff safety, and no patient deaths on the programme. OPAT can be a viable option for PWID provided there is careful patient selection, good patient engagement and sufficient resources allocated for patient management.

**Keywords** PWID · IDU · OPAT · HITH

## Introduction

There has been a global rise in the number of people who inject drugs (PWID) [1, 2]. PWID are at risk of multiple infective complications such as bacteraemia, endocarditis and osteoarticular infections [3]. Such infections can cause significant morbidity; prolonged intravenous antibiotic therapy is often indicated. However, few patients are keen to remain in hospital for protracted periods, and prolonged inpatient stay carries a financial and resource burden.

Outpatient parenteral antibiotic therapy (OPAT) programmes are a well-established method of delivering parenteral antibiotics outside of an acute hospital inpatient setting [4]. OPAT programmes are more cost effective than prolonged

inpatient stay [5], and multiple publications have shown that OPAT is safe [6, 7].

There is controversy regarding the suitability of PWID for OPAT. These patients may use peripherally inserted central catheter (PICC) lines for non-prescribed drug use, which carries risk of toxicity and of line associated bloodstream infection (BSI). Staff safety with home visits is a concern: patients or other household members may have taken psychoactive drugs, and some may have unsuitable accommodation. However, PWID can also be challenging to manage on an inpatient basis. Hospital admission does not exclude the possibility of ongoing non-prescribed drug use [8], and some inpatients have difficulty being present on the ward for all scheduled antibiotic doses.

A significant portion of OPAT programmes will accept care of PWID [9] despite the relative paucity of evidence to support this practice. Successful management of PWID on OPAT has been reported in Singapore, using a seal over the PICC exit port to deter and detect PICC manipulation by the patient [10]. Criteria for risk stratification of PWID into high and low-moderate risk OPAT candidates based on psychological profiling have been published from rural USA, though based on

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small numbers [8]. Other studies from the USA, Canada and Australia have mixed results [11–13].

The view of our institution is that OPAT can provide good care for PWID with careful patient selection and daily patient engagement. This has not previously been studied in a systematic way. Our aim is to review the epidemiology and outcomes of PWID on our OPAT programme.

## Methods

A single-centre retrospective cohort study of PWID admitted to OPAT at our institution was undertaken. The Royal Brisbane and Women's Hospital is a tertiary level urban hospital with 929 beds. The study timeframe was July 2015 to December 2017.

### OPAT programme

Referral for administration of home antibiotics is initiated by treating teams within the hospital or by the emergency department. There are criteria that all patients must fulfil prior to admission to the OPAT programme:

1. Patients should be medically stable.
2. Ongoing parenteral therapy should be indicated for the patient; where an equivalent oral antibiotic is available this is preferred.
3. Patients should have suitable home accommodation and adequate social support.
4. Patients must have two points of phone contact and commit to punctual attendance at appointments.
5. Patients should be engaged in care and there must not be concerns regarding aggressive behaviour during inpatient stay.
6. Patients continuing to engage in non-prescribed drug use during inpatient admission are declined.
7. Patients actively using crystal methamphetamine are declined due to potential increased aggression in this cohort.

OPAT services for PWID in this institution are delivered in several ways. Most patients are managed with home visits from nursing staff, which occur up to twice daily. Some patients attend the hospital day therapy unit daily for antibiotic administration. A PICC is inserted prior to OPAT transition for patients undergoing prolonged parenteral antibiotics; patients undergoing short courses can be managed with peripheral cannula. Antibiotics are administered via an elastomeric balloon infuser over 24 hours, which is changed daily by nursing staff; if antibiotic infusion time is short, then the antibiotic is administered at the time of nurse visit. Ambulatory pumps with antibiotic bags are not generally offered to PWID, due to the high cost of replacement if a device is not returned.

Regarding harm minimization techniques for PWID on OPAT, all PWID are counselled regarding the objectives of OPAT and risks of PICC usage for non-prescribed drugs. PWID are offered addiction services consultation regarding techniques for prevention of future intravenous drug use. They are offered a PICC filter, for use if there is any possibility of non-prescribed intravenous drug use via their PICC, and educated on its usage. Filters reduce risk of new infection should the patient decide to use their PICC for non-prescribed drugs. Dual staff member visits are provided on initial visit to all PWID reporting drug use within the preceding year to assess the safety of future visits; dual staff member visits thereafter are on an as required basis.

Management of patient issues occurs on a 24 hour basis by the nursing and medical team; patients are reviewed in person by medical staff as needed with a minimum frequency of once weekly. Multidisciplinary team meeting occurs twice weekly with medical and allied health teams. Criteria for removal of PWID from OPAT include:

1. Patient not contactable for longer than 24 hours.
2. Patient or household member engages in behaviour deemed to put staff safety at risk.
3. PICC utilisation for non-prescribed drug use.
4. Failure to improve as clinically expected for any other reason.

If a patient is not contactable for 24 hours, police welfare check and removal of intravenous access is arranged. Regarding non-prescribed injecting drug use while undergoing OPAT care, this is not automatically grounds for expulsion from OPAT, provided the PICC is not used and there are no other adverse effects. If there are complications related to non-prescribed drug use while on OPAT, strong consideration is given as to whether ongoing OPAT care is in the patient's best interests.

### Data collection and definitions

Case records of all patients enrolled in OPAT from 01/07/2015 to 31/12/2017 were retrospectively reviewed. Patients documented as self-reporting injecting drug use, or patients suspected as doing so and having positive toxicology screen, were studied further. Data was collected on epidemiology, indication for and duration of OPAT admission. Outcome data was collected at the end of the OPAT care and at up to 6 months post discharge. Data on complications during OPAT admission was collected including new BSI, unplanned hospital re-admission and episodes of non-adherence. Non-prescribed drug use during OPAT admission was defined by either patient self-report, or clinical suspicion based on line appearance and new microbiological findings. Episodes of staff safety concerns were also assessed.

Successful OPAT admission was defined as completion of the parenteral antibiotic course planned during inpatient admission, and expected clinical improvement consistent with length of antibiotic therapy. This definition allows for treatment regimens for which standard of care is a period of parenteral antibiotics followed by oral antibiotics. If a patient missed antibiotic dose(s) during OPAT for any reason but subsequently resumed therapy and otherwise met criteria for successful OPAT completion, this was regarded as a successful admission.

Drug use was quantified based on timing since most recent use: within 1 month, 1–12 months or greater than 12 months. An “episode” of OPAT care was defined as all OPAT care related to a single infection in a patient. If the patient was re-admitted to hospital and subsequently returned to OPAT for ongoing treatment of the same condition, this was regarded as the same episode of OPAT care. Patients could have multiple episodes of OPAT care characterised: if a previously known patient was re-admitted during the study timeframe with a new infection, more than 30 days since their previous OPAT admission, this was regarded as a different episode of care.

## Results

### Patient characteristics

During the study period, there were an overall total of 698 admissions to the OPAT service, with 10,810 bed days of care provided and an overall re-admission rate of 10.1%. Forty-five (6.4%) of all admissions and 724 (6.7%) of all bed days were PWID; these 45 admissions comprised 38 distinct episodes of OPAT care as previously defined. The 38 episodes of care were further assessed. Three patients were admitted to OPAT twice with separate infections during the study period.

The baseline characteristics of the patients are shown (Table 1). Thirty-one (81%) were male with a median age of 37 (range 19–68) years. Ten (26.3%) were taking prescribed opioid replacement therapy, Seventeen (44.7%) were hepatitis C antibody positive, none were positive for HIV and other medical co-morbidities were infrequently reported though seven had a documented psychiatric diagnosis. Fourteen (37%) reported drug use within the preceding month and ten (26.3%) were taking prescribed opioid replacement therapy.

OPAT indication, microbiology and route of antibiotic administration are also shown in Table 1. A broad range of infections were treated; *Staphylococcus aureus* was the most common pathogen. PICCs were inserted prior to discharge in 33 (86.8%) patients. One patient was treated with intramuscular ceftriaxone for 35 days due to technical difficulties with PICC insertion.

**Table 1** Baseline characteristics

	Number (%)	Mean	Range
Total episodes of care	38		
Male	31 (81.6)		
Female	7 (18.4)		
Age		40.7	19–68
Hepatitis C antibody positive	17 (44.7)		
Opioid replacement therapy	10 (26.3)		
Addiction services review	9 (23.7)		
Time since most recent injecting drug use			
< 1 month	14 (36.8)		
1–12 months	6 (15.8)		
> 12 months	18 (47.4)		
Indication for OPAT			
Osteomyelitis	13 (34.2)		
Septic arthritis	7 (18.4)		
Endocarditis	5 (13.2)		
Bacteraemia not otherwise specified	7 (18.4)		
Skin/soft tissue infection	4 (10.5)		
Pneumonia	1 (2.6)		
Renal abscess	1 (2.6)		
Microbiology			
Methicillin sensitive <i>Staphylococcus aureus</i>	20 (43.5)		
Methicillin resistant <i>Staphylococcus aureus</i>	2 (4.3)		
<i>Streptococcus pyogenes</i>	3 (6.5)		
Polymicrobial (including above organisms)	6 (13)		
No positive microbiology	2 (4.3)		
Other (cultured twice or less)	13 (28.3)		
Route of antibiotic administration			
PICC	33 (86.8)		
Peripheral intravenous cannula	4 (10.5)		
Intramuscular	1 (2.6)		

### Outcomes

Twenty-eight (73.7%) of 38 episodes of care for PWID were completed successfully, defined as completion of planned parenteral antibiotic course and expected clinical improvement consistent with duration of therapy. PWID were cared for by the OPAT service for a median duration of 14 days, with a cumulative total of 724 bed days. There was a total of 778 home visits provided to PWID.

Ten (26.3%) patients did not complete their OPAT admission successfully. Reasons for non-completion are shown (Table 2). Four did not attend, while six patients were re-admitted to hospital and not returned to OPAT. Data on outcome following OPAT discharge is limited due to poor attendance at follow-up. A single case of

**Table 2** Outcomes and complications

	Number (%)	Number (range)
Successful OPAT completion	28 (73.7)	
Median duration of OPAT admission		14 days (1–49)
Total PWID bed days on OPAT	724	
Total nursing home visits to PWID on OPAT	778	
Outcome related to timing of injecting drug use		
Most recent drug use < 1 month	14	
Successful OPAT completion	9	
OPAT not successfully completed	5	
Most recent drug use 1–12 months	6	
Successful OPAT completion	4	
OPAT not successfully completed	2	
Most recent drug use > 12 months	18	
Successful OPAT completion	15	
OPAT not successfully completed	3	
Outcome at 6 months post OPAT completion		
No data	21	
Cure	14	
Relapsed infection	1	
Unknown	2	
Complications		
Did not successfully complete OPAT	10	
Did not attend/uncontactable	4	
Bloodstream infection	3	
Ankle pain with ongoing drug use	1	
Not coping at home	1	
Medication adverse effect	1	
Re-admitted to hospital	14	
Bloodstream infection	3	
Failed source control	5	
Medication adverse effect	3	
Other	3	
PICC complications	4	
Bloodstream infection	4	
Thrombosis	0	
Non-adherence		
Missed scheduled appointment	19	
Missed scheduled antibiotic dose	8	
Suspected/confirmed non-prescribed drug use	5	
Staff safety concern	0	

relapsing infection was related to retention of infected metal-ware. Two cases are listed as “unclear”: one was re-admitted with *Staphylococcus aureus* infective endocarditis 4 weeks after completion of OPAT admission for septic arthritis with the same pathogen, with injecting drug use between hospital admissions; the other was re-admitted with back pain 5 months

after treatment for vertebral osteomyelitis and self-discharged prior to investigation.

Outcomes related to timing of most recent self-reported episode of drug use are also shown in Table 2. Patients reporting most recent drug use as more than 12 months prior to their OPAT admission completed OPAT successfully in 83.3% of cases; success was less frequent in other groups.

## Complications

Complications occurring during OPAT care are shown in Table 2. There were three cases of new BSI during the study timeframe: all were polymicrobial blood culture growths not consistent with previous microbiology. Two of these three patients reported non-prescribed drug use via PICC. All were managed with removal of the line and institution of appropriate antimicrobial therapy, and all had clinical response without long-term complications. Potential risk of ongoing OPAT care was felt to outweigh benefit for these patients, and they were all removed from the programme.

There were two other incidents of patients engaging in non-prescribed drug use while undergoing OPAT care. One of these was re-admitted with ankle pain diagnosed as subtalar collection and not subsequently returned to OPAT; the other self-reported using heroin but denied PICC usage. This second patient had no clinical deterioration and completed OPAT care as planned.

Nine (23.7%) patients were re-admitted to hospital during the study timeframe, with a cumulative total of 14 re-admissions. Reasons for re-admission are shown in Table 2, and include need for surgical source control, new BSI and medication adverse effects.

A cumulative total of 778 nursing home visits were provided to PWID over the course of this study. Episodes of patient non-adherence with home visits are shown (Table 2). Four patients either did not attend or became not contactable during their OPAT admission. These were removed from OPAT care; all were alive following welfare checks. There were 19 (2.4%) missed scheduled nursing visits throughout the study. In the event of a missed visit, the nurse would contact the patient to re-arrange. With these efforts, there were only 8 (1%) missed antibiotic doses across the entire cohort, involving 5 different patients. In order to minimise missed antibiotic doses, antibiotics were administered in a variety of settings including a workplace, a supermarket car park and a patient’s balcony as the internal house was not suitable for nursing staff to enter.

There were no staff safety adverse events during the study timeframe. Whether nursing staff felt safe to visit alone subsequent to initial dual staff member visit was at their own discretion. There were no patient deaths on the programme.

## Discussion

PWID admitted to the Royal Brisbane and Women's Hospital OPAT programme occupied 724 bed days over the study period July 2015–December 2017. 73.7% of these OPAT admissions were completed successfully. In terms of complications, 23.6% of the cohort were re-admitted on at least one occasion, new bloodstream infection occurred in 7.9% and continued non-prescribed drug use was seen in at least 10.5% of cases. Compliance with oral antibiotics and long-term outcomes following discharge from OPAT is unknown.

Defining “successful” outcome for OPAT in PWID is difficult; previous studies have varied considerably in the definition of success. Ho et al. used completion of planned duration of antibiotic therapy as their outcome, regardless of clinical status at time of parenteral antibiotic completion or frequency of missed doses [10]. Dobson et al. added the caveat of “measurable signs of clearance of infection” [12]. In contrast, Buehrle included any episodes of non-adherence, including with follow-up appointments, as a failed outcome [11]. In our study, we used a pragmatic definition whereby success was defined as completion of parenteral antibiotic course as planned during inpatient admission, with clinical improvement consistent with the length of antibiotic therapy. This meant that need for surgical source control, antibiotic side effects or a missed antibiotic dose with subsequent resumption of parenteral therapy was not regarded as failure.

Care of PWID and harm minimization can be challenging both as inpatients and via OPAT. Keeping patients in hospital does not necessarily prevent ongoing non-prescribed drug use or its complications [8], but providing a PICC to PWID in the OPAT setting carries a risk that the PICC will be used for non-prescribed drugs. This exposes the patient to risk of further harm. Our harm reduction measures included intensive counselling and patient engagement regarding the objectives and risks of OPAT, the offer of addiction services referral and the provision of PICC line filters. At least 10.5% of our cohort participated in non-prescribed intravenous drug use while under OPAT care: it is difficult to quantify the success of our harm minimization techniques due to the lack of a comparator group.

Risk of patient safety adverse events is often used to decline OPAT admission for PWID. In our study, there were three episodes of bloodstream infection and one hospital re-admission due to ankle pain secondary to non-prescribed drug use. There were no long-term sequelae of these complications; this is likely at least partly due to the close monitoring and patient engagement provided by nursing and medical staff. However, these events are of concern for institutions considering accepting PWID to OPAT. There were no episodes of staff safety adverse events during the study period, which is likely reflective of the cautious approach our institution adopts to staff safety at all times.

In this study, PWID were labour intensive to manage in the OPAT setting. 23.7% of patients were re-admitted on at least one occasion. This is more than double the overall re-admission rate (10.1%) at our institution for all OPAT patients over the study timeframe. It is however in keeping with previous publications of PWID on OPAT [13, 14]. Patients were not present at the appointed time of nursing visit at 2.4% of home visits. Despite this, only 1% of antibiotic doses were missed, which reflects the efforts of our nursing staff to provide optimal care to these patients. Four patients did not attend or became uncontactable while on OPAT, which necessitated police welfare checks. This is time consuming, and clinicians should be aware of these issues and have adequate staffing and protocols for such episodes prior to accepting PWID to OPAT services.

In assessing the results of this study, it is important to note that there is selection bias in the PWID who are accepted to OPAT care. Data has not been collected on PWID declined admission to the OPAT service, and inpatient treating teams within the hospital may not have referred PWID to OPAT due to their own reservations. Study findings cannot be extrapolated to PWID who were considered too high risk for admission to our OPAT service. Furthermore, this study is set in a high resource country with ample access to psychiatric services and treatment programmes to support PWID in abstaining from injecting drug use [15]. Results are therefore not generalizable to all settings.

Potential approaches to improving our service could include mandated review from the addiction services team for all PWID prior to OPAT admission, and the provision of a written contract to formalise expectations regarding behaviour. Our results show more successful OPAT completions in patients whose most recent injecting drug use was more than 12 months previously, which is in line with previous studies [8]. Duration of time since injecting drug use could potentially be used as part of risk stratification of PWID referred to OPAT services.

## Conclusion

OPAT can be a suitable treatment setting for PWID in Australia provided sufficient resources are allocated for patient management.

## Compliance with ethical standards

**Conflict of interest** The authors declare that they have no conflict of interest.

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