

The hidden cost of dalbavancin: OPAT RN time required in coordination for persons who use drugs

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Abstract

Background: Serious infections in persons who use drugs (PWUD) are rising. Dalbavancin, due to its extended half-life, offers an alternative treatment for patients in whom standard of care antibiotics are not feasible or practical, allowing for reduced hospital days and the avoidance of central line placement or the use of complex oral regimens.

Objectives: We aim to describe the time and effort required for coordination of dalbavancin courses by outpatient registered nurses (RNs) and other outpatient parenteral antimicrobial therapy (OPAT) staff.

Design and methods: We conducted a retrospective review of adult patients with documented substance use who received at least one dose of dalbavancin and quantified the number of interventions required by our OPAT RNs and other OPAT staff for coordination of dalbavancin courses. Additionally, detailed data on time spent per intervention were prospectively collected for a 1-month period.

Results: A total of 52 patients with 53 dalbavancin courses were included. Most substance use was intravenous. Infectious diagnoses included bone and joint infections (61%) and endocarditis (7%), in addition to skin and soft tissue infections (19%). Infections were most commonly caused by *Staphylococcus aureus* (62%). RN intervention was required in the coordination of 60% of all courses and in 77% of courses in which at least one outpatient dose was needed. Adverse reactions occurred in one patient (2%) and 90-day readmissions due to infectious complications occurred in two patients (4%). Detailed time analysis was performed for seven consecutive patients, with a total of 179 min spent by OPAT RNs on coordination.

Conclusions: The ease of dalbavancin administration does not eliminate the need for extensive RN coordination for successful administration of doses in the outpatient setting for PWUD. This need should be accounted for in program staffing to help increase successful dalbavancin course completion.

Keywords: dalbavancin/long-acting glycopeptides, nurse coordinator, outpatient parenteral antimicrobial therapy, PWUD

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Background

The opioid and amphetamine epidemics have a significant impact on healthcare systems in the United States. Nationally, rates of hospital admissions for serious infections among persons who use drugs

(PWUD) continue to rise, having more than doubled between 2012 and 2017.¹ People who inject drugs (PWID) are at an increased risk for skin and soft tissue infections (SSTI), sepsis, bone and joint infections, endocarditis,² and are more likely to

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have infections due to methicillin-resistant *Staphylococcus aureus* (MRSA).¹ Complicated infections such as endocarditis and osteomyelitis have traditionally been treated with long courses of intravenous (IV) antibiotics.³ Despite the increasing body of evidence demonstrating safe and successful outpatient completion rates in PWID, including a study that reported a 100% completion rate when evaluated for specific safety criteria prior to OPAT, stigma surrounding this patient population persists.⁴ In a survey of Infectious Diseases (ID) physicians, more than 40% reported that they never offered patients with substance use disorders (SUD) outpatient IV antibiotics.⁵ Concern for peripherally inserted central catheter (PICC) safety and feasibility outside of the hospital often limits antibiotic setting options for PWID,⁵ as does structural discrimination, which lowers their acceptance rates into many skilled nursing facilities or rehabilitation settings. Although there is good evidence that oral (PO) antibiotics can be used instead of IV antibiotics for many severe infections^{6–8} the complex regimens and many structural determinants of health that destabilize the lives of this patient population create many opportunities for oral antibiotic courses to be incompletely taken.

Dalbavancin, a long-acting lipoglycopeptide with once-a-week dosing, has potent activity against most gram-positive organisms, including MRSA, and is an enticing alternative to IV antibiotic regimens that require a PICC, daily dosing, and weekly lab monitoring, as well as some of the complex oral regimens mentioned above. The use of dalbavancin has been described as a viable alternative to standard of care daily IV antibiotics,⁹ although ongoing clinical trials are needed to provide evidence of non-inferiority to standard of care for more complicated infections.¹⁰ The simplified dosing regimen can result in reduced hospital length of stay and significant cost savings to the healthcare system, but the ambulatory care requirements when used for complex infections are poorly described.⁹

We aim to describe the time and effort required for coordination of dalbavancin courses by outpatient parenteral antimicrobial therapy (OPAT) registered nurses (RNs) and other staff.

Methods

This is a multipart study with both retrospective and prospective data collection. First, we

conducted a retrospective review of dalbavancin use between 1 April 2015 and 31 December 2019 for any patient with documented history of substance use (active or in any phase of recovery) by either ICD-10 or in chart notes, including alcohol use, defined in this article as PWUD. We identified all patients ≥ 18 years of age who received ≥ 1 confirmed dose of dalbavancin *via* medication records using SAP BusinessObjects Enterprise Business Intelligence Platform 4.2 (SAP America, Inc., PA, USA). Most patients who received dalbavancin are enrolled in our OPAT program. Patient demographics, resources such as working phone and clinical outcomes data, as well as OPAT staff interventions in dalbavancin coordination were collected *via* electronic medical record review. Interventions were recorded from chart notes during the dalbavancin therapy window and consisted of any work done by a member of the OPAT team in the coordination of the dalbavancin course, including calls to patients and antibiotic vendors (home infusion pharmacy, infusion center, or skilled nursing facility), preparation of orders, transportation coordination, monitoring lab results, and triage of dalbavancin-related patient issues such as adverse reactions or venous access complications. Our OPAT program includes OPAT RNs who provide a specific scope of antibiotic coordination, a clinical ID pharmacist who assists with dosing and clinical recommendations, an MA who coordinates laboratory data and ID physicians. Additionally, OPAT RNs prospectively recorded the amount of time spent per intervention on any patient receiving dalbavancin over a 1-month period from April to May of 2021. This calculation did not include initial time spent coordinating dalbavancin doses by inpatient RN case managers, who are the initial coordinators of planned outpatient infusions for currently admitted patients.

Results

Of the 52 patients, a total of 53 dalbavancin courses were included with a mean age of 44.8 years (range 23–70 years), and 32% were female. The most common infectious diagnoses were non-vertebral bone and joint infection in 21 (40%) patients, vertebral osteomyelitis in 13 (25%) and endocarditis in 5 (9%) (Table 1). The most common causative organism was *S. aureus*, with MRSA in 23 (43%) and methicillin-sensitive *S. aureus* (MSSA) in 10 (18%). Eight patients

Table 1. Patient demographics.

Patient demographics	n = 53 courses
Age (years); mean	44.8 (STD 11.2)
Gender (Female)	17 (32%)
Infection characteristics	n (%)
Bacteremia	25 (47)
Duration of bacteremia; days (median; range)	1 (1–19)
Primary indication	
Bone and joint infection (non-vertebral)	21 (40)
Vertebral osteomyelitis	13 (25)
Endocarditis	5 (9)
Skin and soft tissue with bacteremia	5 (9)
Bacteremia alone	7 (13)
Skin and soft tissue alone	2 (4)
Organism	
MRSA	23 (43)
MSSA	10 (18)
CoNS	3 (6)
<i>Enterococcus faecalis</i>	2 (4)
<i>Corynebacterium spp</i>	2 (4)
<i>Cutibacterium acnes</i>	2 (4)
Polymicrobial	7 (13)
No culture	1 (2)
Negative cultures	3 (6)
Substance use history*	
Intravenous opioid use	27 (51)
Intravenous methamphetamine use	27 (51)
Inhaled methamphetamine use	2 (4)
Opioid use, non-IV route	3 (6)
Alcohol use	11 (21)

(Continued)

Table 1. (Continued)

Polysubstance use	16 (30)
<i>*Totals represent more than 100% as polysubstance use occurred</i>	
Reason for selection of dalbavancin	n
History of intravenous substance use	36
Lack of safe home environment in which to receive daily IV antibiotics	13
Prior nonadherence to outpatient antibiotics	10
Prior history of contaminated/manipulated PICC	5
Clinical contraindications to alternative antibiotic options	4
Substance use, not IV	4
Patient refused PICC or daily outpatient IV antibiotics	4
Discharging to a setting that could not accommodate daily IV antibiotics	3
Inability of patient to physically manage PICC	3
Lack of outpatient options due to funding/insurance issues	2
Prior treatment failure	1
Adverse reaction to initial outpatient antibiotic	1
<i>Dalbavancin was selected for one or more of the above reasons, all reasons given in medical record were noted</i>	
Dalbavancin dosing regimens	n (%)
1500 mg × 1	25 (47)
1500 mg × 2	16 (31)

(Continued)

Table 1. (Continued)

Dalbavancin dosing regimens	n (%)	
1500 mg ×1, 1000 mg ×1	1 (2)	
1000 mg ×1	5 (9)	
1000 mg weekly ×6	1 (2)	
1000 mg ×1, 500 mg weekly	5 (9); range 4–5 doses	
Number of patients receiving a single dose of dalbavancin to complete a course of therapy	30 (57)	
Insurance coverage		
Medicaid	37 (70)	
Medicare	5 (9)	
Commercial	2 (4)	
Other	2 (4)	
Multiple insurance providers	7(13)	
Uninsured	0	
Dalbavancin treatment setting	Number of patients infused	Number of doses infused
Inpatient	31	33
Infusion center	14	38
Home infusion	11	16
Emergency department	1	1
Correctional facility	2	2

(15%) received concurrent oral antibiotics. Forty-one (77%) patients reported IV substance use. The OHSU Addiction Medicine service (IMPACT) was consulted on 28 (53%) of patients. Our institution’s novel multidisciplinary treatment planning conference (OPTIONS-DC)¹¹ was held for 17 of 40 (42.5%) eligible patients as the start of our study period predates the initiation of these conferences. The majority of patients, 37 (70%), were insured by Medicaid.

The most common reasons for selection of dalbavancin over standard of care antibiotics recorded in the chart by the ID consult service were a history of injection drug use, lack of a safe home environment in which to receive daily IV antibiotics, and prior nonadherence to outpatient antibiotics (Table 1).

A total of 31 (58%) patients received at least one dalbavancin dose in the hospital, while 14 (26%) patients received their dalbavancin course entirely in the outpatient setting. Of those who received any inpatient dalbavancin, 24 (77%) patients completed their dalbavancin infusions in the hospital, and the remaining 7 (23%) required further outpatient doses. All 53 (100%) courses were ultimately completed.

OPAT RN interventions occurred in 32 (60.3%) of all dalbavancin regimens (Table 2). When comparing interventions by treatment setting, for courses completed inpatient, OPAT RN intervention was required for 6 (25%). For courses including at least one outpatient dose, OPAT RN intervention was required for 17 (77.3%). The most common interventions included reaching a patient by phone for coordination of infusion appointments or labs. There were a total of 171 RN interventions, with a mean of 3.35 interventions (STD 5.11) or median of 1 (range 0–31) per patient. For courses including at least one outpatient dose, there were a total of 143 RN interventions with a mean of 4.93 interventions (STD 5.98) or median 4 (range 0–31) per patient.

The 1-month prospective review of dalbavancin coordination time included seven patients. A total of 19 interventions and 179 min were devoted to dalbavancin coordination, with a mean of 8.9 min (STD 5.7) or median 7.50 (range 1–24) in RN intervention per patient dalbavancin course. The interventions requiring the most RN time in dalbavancin coordination included coordination of outpatient dalbavancin infusion appointments and attempting to reach patients for appointment and lab coordination.

As far as treatment outcomes, adverse reactions were documented for one (2%) patient, consisting of nausea, vomiting, and diarrhea following infusion but did not require hospital admission. A 90-day recurrence or relapse of infection occurred for two (4%) patients, both of whom were

Table 2. Study outcomes.

RN coordination interventions	<i>n</i> (%)
Total courses with RN interventions	32 (60.3)
Total courses with OPAT RN interventions that included >1 outpatient dose	17 (77.3)
Total courses with OPAT RN interventions that included a single dose	15 (48)
Total OPAT RN interventions	171
Other OPAT staff interventions	27
RN intervention per patient—mean (STD)	3.35 (5.11)
	Median 1 (range 0–31)
	<i>n</i> (%)
Total courses with RN interventions	32 (63)
Total courses with RN interventions that included >1 outpatient dose	17 (77.3)
Total OPAT RN interventions	171
Other OPAT Staff Interventions	27
Other OPAT staff intervention per patient—mean (STD)	0.73 (1.24)
	Median 0 (range 0–5)
Type of OPAT intervention needed for coordination	
RN entered orders	10
RN call to confirm dose administration	12
RN call to patient for coordination	16
RN Transitional Care Management Call to patient	10
MD action	6
OPAT PharmD Coordination	4
RN coordination for IV access	4
RN coordination with vendor	14
RN coordination with lab	4
RN coordination other	3
Medical sssistant coordination	3
RN addressing symptoms related to dalbavancin infusion	6
Scheduler coordination	3
One month prospective review of time RN spent (<i>n</i> = 7 patients)	
Total RN time spent on dalbavancin coordination	179 min

(Continued)

Table 2. (Continued)

RN coordination interventions	n (%)
Average time spent per patient	9.2 (range 6–20 min)
Total RN time spent on preparation and conducting OPTIONS-DC conferences	97 min (mean 48.5 min per patient)
Treatment outcomes	
Adverse reaction	1 (2)
90-day readmission due to complication of antibiotic course	0
90-day readmission due to complications of infection	2(4)
90-day recurrence or relapse of infection 90 days without requiring admission	0
90-day mortality	1 (2)

readmitted to the hospital. A 90-day mortality occurred for one (2%) patient.

Discussion

Dalbavancin is an attractive option for PWUD but to optimize success in this patient population with many barriers, diligent care coordination is required. Potential barriers for OPAT in PWUD include lack of access to a working phone, unstable housing, lack of reliable transportation, inaccessible infusion services for people living in rural areas and financial barriers for uninsured patients or patients for whom dalbavancin may not be covered by insurance. RN-managed OPAT programs have been shown to reduce rates of readmission and therefore result in significant cost savings to health institutions and may help navigate some of the above barriers.¹² In our study, the majority of the recorded interventions were conducted by OPAT RNs compared to the rest of the OPAT team. For regimens requiring at least one dose of dalbavancin outside of the hospital, multiple OPAT RN interventions were required for the majority of patients. These interventions included coordination with antibiotic vendors, lab vendors and patients, as well as vascular access coordination for patients who had difficult venous access. Despite the fact that a majority (74%) of infections were complex (bone and joint infection or endocarditis), all 53 dalbavancin courses were completed successfully. Given the study population and successful completion rate, it is important to note the relatively low number of adverse reactions and 90-day readmissions.

Although dalbavancin use in PWID has been described,^{13,14} our study is the first to detail the effort required for successful coordination of dalbavancin in the outpatient setting. Our study adds to the literature on dalbavancin use by delineating both the specifics of coordination, the obstacles encountered and provides an estimate of the time involved. Additionally, the need for thoughtful care coordination applies to those with alcohol use disorder,¹⁵ which comprised 21% of our study population. The most common interventions for OPAT RNs were phone calls to the patients to coordinate doses which can be challenging when the electronic medical record has inaccurate contact information, or the patient does not have a phone. Of the 17 patients who had an OPTIONS-DC conference, only 4 (23.5%) had a confirmed working phone during admission, which speaks to PWUD being further removed from their healthcare staff simply due to a lack of communication device. RN coordination with vendors is similar for any coordination of IV antimicrobial therapy but commonly overlooked when assessing the overall cost of administering dalbavancin, likely because it often only requires one outpatient dose. One outpatient consideration for dalbavancin coordination for PWUD is the patient's vein status which in our study required four interventions to ensure successful dalbavancin administration outside of the hospital.

At our institution, a large portion of RN time is devoted to conducting OPTIONS-DC discharge planning conferences while a patient is still

admitted. PWUD admitted with serious infections are often followed by the IMPACT team and often have an OPTIONS-DC conference which is a multidisciplinary discharge planning meeting that uses a structured tool to review risk and protective factors and helps determine safe treatment options for PWUD with serious infections, while emphasizing patient preferences and harm reduction.¹¹ Patients who leave the hospital on IV antibiotics, including dalbavancin, are then enrolled in the OPAT program. Recommendations from the OPTIONS-DC, implemented in February 2018, resulted in significantly higher use of dalbavancin for treatment or completion of treatment at 27.4% compared to those with substance use disorder (SUD) who did not have an OPTIONS-DC (9%).¹⁶ This highlights that successful coordination of dalbavancin courses begins prior to hospital discharge, and requires comprehensive planning, because patients may be unreachable once they leave.

The nuances of insurance coverage further complicate the coordination of dalbavancin. For example, Medicare Parts A and B will not cover home infusion costs for antibiotics, therefore many patients must travel to an infusion center for their dalbavancin dose if they cannot afford the out-of-pocket home infusion cost. This requires additional resources such as reliable transportation and access to infusion settings in rural areas. Rural infusion pharmacies may struggle to supply this medication based on their formulary limitations. Oregon Medicaid generally covers dalbavancin infusions across many settings; however, in states with less robust coverage, higher rates of uninsured patients, or private insurances that do not cover the medication, this likely presents an additional barrier to coordination.

Another barrier to completing antibiotics in PWUD is the stigma often experienced in healthcare settings. In surveys of PWID, 78–88% of patients reported having experienced stigma in healthcare on at least one occasion.^{17,18} Additionally, patients identified avoiding stigma in healthcare by delaying presentation, not disclosing drug use, and downplaying pain although patients did report having more positive experiences at community-based organizations like syringe service programs.^{17,18} Additional barriers to seeking care were identified as difficulty attending appointments due to

competing priorities (e.g. finding shelter and obtaining and using drugs to prevent opioid withdrawal). Systemic failures related to difficulty navigating the US healthcare system, unreliable transportation, and long wait times were also commonly identified.^{17,19} Although these surveys were aimed at primary and preventative care, this stigma persists among ID physicians as well.⁵ These experiences discouraging PWUD from seeking preventative care likely also play a role in outpatient follow-up for antibiotic infusions like dalbavancin. In addition to stigma and healthcare systems failures, overarching structural determinants of health pressing down on this population to create unstable housing, food insecurity, lack of agency, and fear of society pose significant barriers to ‘adherence’. In our experience, assessing a patient’s history with medical appointment adherence can help identify a person with multiple of these vulnerabilities, this as well as assessing patient’s current stated desires for infection treatment, are predictors of success in dalbavancin courses requiring follow-up.

Limitations

There are several limitations in this study, including the retrospective chart review that relied on documentation of each intervention. This data are likely an underestimate of the work that happened as we collected only documented interventions performed by the OPAT team but not undocumented interventions or coordination by inpatient RN case managers. Additionally, the time-tracking phase of the study included only a small subset of patients and may under or overestimate the time spent per patient in the entire cohort. This data were also from a single center with an established multidisciplinary care conference supporting antibiotic treatment planning in PWUD, so may underestimate the dalbavancin-related effort required at other centers or in US states with less robust Medicaid coverage than Oregon.

Future directions

Future studies to improve dalbavancin administration success could include coordination with outpatient social workers and community partners to decrease needed phone calls and transportation coordination. Given that PWID report positive experiences at syringe service

programs, evaluating dalbavancin infusions in these community settings may also be useful. Evaluating patient perspectives around outpatient antibiotics, improving access to cell phones and other resources, and cost analysis of OPAT RN coordination time would better inform our understanding and improve the success of dalbavancin use in PWUD. Additionally, this RN coordinator model could be applied to care for PWUD outside of long-acting glycopeptides, such as in the treatment of sexually transmitted infections and chronic hepatitis C virus infections.

Conclusion

Successful use of dalbavancin in PWUD requires significant coordination as represented by the number of OPAT RN interventions. Though use of dalbavancin can offer potential cost savings to health systems, the cost of coordination needs to be considered. Institutions frequently recommending dalbavancin in this population should be resourced and staffed to support effective implementation. In this vulnerable population that experiences stigma within the healthcare system, the length of stay for infection treatment and the resulting cost are often scrutinized. Although dalbavancin provides an alternate option for some infections and patients, it does not eliminate the need for patient-centered care and patient autonomy in treatment decisions as well as randomized controlled trials to evaluate non-inferiority to current standards of care.

Declarations

Ethics approval and consent to participate

The Institutional Review Board (IRB) of Oregon Health and Science University approved this study (STUDY00019525). Informed consent was waived by the IRB. This retrospective chart review involving human participants was in accordance with the ethical standards of the institutional and national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

Consent for publication

Not applicable.

Author contributions

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Competing interests

The authors declare that there is no conflict of interest.

Availability of data and materials

The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

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