

From sea to shining IV: the current state of OPAT in the United States

Jeffrey Larnard , Kyleen Swords, Dan Taupin and Simi Padival

Ther Adv Infect Dis

2023, Vol. 10: 1–5

DOI: 10.1177/
20499361231181486

© The Author(s), 2023.
Article reuse guidelines:
[sagepub.com/journals-
permissions](https://sagepub.com/journals-permissions)

Abstract: First described in the United States, outpatient parenteral antibiotic therapy (OPAT) has become an indispensable part of treating serious infections. The proportion of infectious disease (ID) physicians utilizing a formal OPAT program has increased in recent years, but remains a minority. In addition, many ID physicians have indicated that OPAT programs have inadequate financial and administrative support. Given the medical complexity of patients receiving OPAT, as well as the challenges of communicating with OPAT providers across health care facilities and systems, OPAT programs ideally should involve a multidisciplinary team. The majority of patients in the United States receive OPAT either at home with assistance from home infusion companies and visiting nurses or at a skilled nursing facility (SNF), though the latter has been associated with lower rates of patient satisfaction. Current and future opportunities and challenges for OPAT programs include providing OPAT services for people who inject drugs (PWID) and incorporating the increasing use of oral antibiotics for infections historically treated with parenteral therapy. In this review, we will discuss the current practice patterns and patient experiences with OPAT in the United States, as well as identify future challenges and opportunities for OPAT programs.

Keywords: antibiotic, OPAT, outpatient, parenteral, therapy, United States, USA

Received: 1 March 2023; revised manuscript accepted: 24 May 2023.

Introduction

Outpatient parenteral antimicrobial therapy (OPAT) was first described in the United States in 1974 for the treatment of pulmonary infections in children with cystic fibrosis.¹ Since that time, advances in vascular access technology, infusion devices, antibiotic options, and the availability of structured support services have led to a significant expansion of OPAT.² Bone and joint infections, endocarditis, bacteremia, and complicated skin/soft tissue infections are all now common indications for OPAT in the United States.^{3,4} The Infectious Disease Society of America (IDSA) most recently released guidelines for OPAT programs in 2018, which highlight the ability of OPAT programs to reduce hospitalization duration and health care costs.⁵ However, OPAT programs still face headwinds, often related to the fractured landscape of US health care.

Overview of the US Health Care System

In total, 330 million people living in the United States⁶ are served by 417 different health systems, and over 6000 hospitals.⁷ The United States has the unfortunate distinction of being the only wealthy industrialized nation without universal health coverage, with over 37 million uninsured and 41 million more with inadequate access to care. Affordability of health coverage is a common barrier for the uninsured population.^{8,9} The United States has a mix of health insurance models, with some individuals receiving insurance through public funding (i.e. Medicare and Medicaid) and others receiving insurance through employers or purchased individually. In total, the United States has over 900 health insurance companies¹⁰ with the majority covering home infusion services. However, a significant exception is Medicare, which is the government-administered, primary health insurance

Correspondence to:
Jeffrey Larnard
Division of Infectious
Diseases, Beth Israel
Deaconess Medical
Center, Boston, MA 02215,
USA.
jlarnar@bidmc.harvard.edu

Kyleen Swords
Division of Infectious
Diseases, Beth Israel
Deaconess Medical
Center, Boston, MA, USA

Dan Taupin
Division of Infectious
Diseases, Jefferson
Health, Philadelphia, PA,
USA

Simi Padival
Division of Infectious
Diseases, University of
Pittsburgh Medical Center
Health System, Pittsburgh,
PA, USA

payor for adults over 65 years of age. Patients with Medicare may have to incur significant out-of-pocket costs for home infusion services.¹¹

Current OPAT practice patterns and challenges in the United States

In the United States, OPAT programs are usually run by infectious diseases (ID) clinicians employed by academic medical centers or private practices. In a 2018 survey of 507 ID physicians in various clinical settings in the United States, 36% of respondents reported using a dedicated OPAT program or service to monitor patients on OPAT.¹² This was increased from 26% in a 2012 survey of the same network of ID physicians by Lane *et al.*,¹³ though still clearly a minority. The presence of a formalized OPAT program is a strong recommendation made by the IDSA⁵ and has been identified as a core quality indicator for OPAT.¹⁴ The rates of reported adverse drug events and vascular access complications during OPAT vary across studies.⁵ However, they are common enough to warrant regular lab monitoring, care coordination, and symptom management as important risk mitigation strategies. OPAT programs in the United States should ideally include physicians, advance practice providers, registered nurses, pharmacists, and medical coordinators, with other practitioners involved as needed to provide comprehensive care.^{15,16}

In the aforementioned 2018 survey study of ID physicians in the United States, only 37% reported that ID consultation was mandated prior to discharging patients on OPAT.¹² This is notable as ID consultation during OPAT has been associated with improved outcomes⁴ and is endorsed by the IDSA.⁵ Most respondents did not feel that OPAT services were well-supported financially, and that administrative support was not adequate for the care of OPAT patients.¹² Perceived barriers to safe OPAT care included laboratory results not returning in a timely fashion, lack of leadership support for OPAT, and difficulty with communication with providers at other facilities providing OPAT care.¹² Of note, there are no current national standardized OPAT databases or repositories for benchmarking in the United States⁵ despite the identification of outcome monitoring as a 'core quality indicator' for individual OPAT programs.^{2,14}

The patient experience in the United States

Patients receiving OPAT at home with assistance from home infusion companies and home health agencies is the most common OPAT delivery method in the United States, followed by patients receiving OPAT at post-acute care facilities [i.e. skilled nursing facilities (SNF), rehabilitation centers]. Patients may also receive OPAT care at an infusion center, either affiliated with a hospital system or owned by a physician group, or at their dialysis center.¹²

Patients who receive OPAT at home in the United States are generally assigned an infusion company and a nurse from a visiting nurses association.¹² Infusion companies are usually responsible for teaching patients and caregivers how to administer antimicrobials at home. This instruction generally occurs during the transition from the acute care facility to home. In a semi-structured interview of patients discharged home with OPAT, patients noted significant potential barriers to learning about OPAT during this time period. This included rushed instruction and confusing or inaccurate instruction manuals.¹⁷ Infusion companies are also responsible for delivering medications and infusion supplies to patients during their treatment course. Visiting nurses will generally visit patients once weekly to change the dressing on their venous access device and draw labs. Thus, patients and caregivers are generally responsible for the daily administration of antibiotics. Despite these challenges and complexities, the safety of patients and caregivers self-administering antimicrobials has been demonstrated by multiple observational studies¹⁸⁻²⁰ and is endorsed by the IDSA.⁵

Patients in the United States who are insured by Medicare may also have daily costs for home services and medication supplies that are untenable.¹¹ As a result, some Medicare patients may opt to receive OPAT care at infusion centers or at an SNF to avoid out-of-pocket costs.²¹ However, patients who receive OPAT care at SNFs may have lower rates of satisfaction compared with patients receiving OPAT at home.²¹ In addition, retrospective data from two health care systems in the United States suggest that patients who receive OPAT care at SNF may be more likely to be readmitted to an acute care facility.^{22,23}

Future challenges and opportunities for US OPAT programs

In the setting of increasing hospitalizations for infectious complications of opioid use disorder,²⁴ there is a great need to evaluate the safety and efficacy of home OPAT for people who inject drugs (PWID). A 2018 systematic review found that OPAT completion rates, mortality, and catheter-related adverse events were similar among PWID and patients without injection drug practices. In addition, rates of misuse of venous catheters were low²⁴ despite this being a reported barrier for US providers to enroll PWID in OPAT.²⁵ OPAT programs in the United States have reported good outcomes for PWID who were enrolled in OPAT with concurrent addiction treatment.^{26,27} However, many practices remain under-resourced to provide these services during OPAT.

The emergence of long-acting glycopeptides, including dalbavancin and oritavancin, also provides an attractive alternative to patients with serious infections who otherwise may not be ideal candidates for home OPAT therapy.^{28,29} Though not approved for use outside of soft tissue infections by the US Food and Drug Administration (FDA), these antibiotics have been described in observational studies and a small randomized trial as effective treatment for serious infections such as infective endocarditis and osteomyelitis.^{29–31} Though cost may be a barrier to use, the use of long-acting glycopeptides have been associated with shorter hospital length of stays, which is appealing for both patients and hospital administrators.^{28,32}

Another emerging opportunity and challenge for OPAT programs in the United States, similar to other parts of the world, is the increasing evidence from randomized controlled trials that oral therapy is equivalent to parenteral therapy for many infections historically treated with parenteral therapy (e.g. endocarditis and osteomyelitis).³³ The use of oral therapy eliminates the complications and economic effects of long-term venous access devices. However, many oral regimens still require regular lab monitoring and close follow-up to ensure tolerability.^{34,35} OPAT programs in the United States and elsewhere will still need to take an active role in helping to take care of these patients, and indeed some OPAT programs have been already rebranded as ‘COpAT’ (complex outpatient antimicrobial therapy).³⁶

Conclusion

Over the last half-century, OPAT has grown to become an integral part of treating serious infections in the United States. However, despite the ability of OPAT to decrease hospital length of stay and health care costs,⁵ a minority of ID clinicians in the United States use a formal multidisciplinary OPAT program.¹² The relative lack of formal OPAT programs in the United States is detrimental to patient care, as these programs are essential for complex care coordination across health care systems. Ideally, the availability of dedicated OPAT teams in the United States will increase as clinicians and researchers continue to demonstrate their value to hospital administrators, insurers, and other governing bodies.

Declarations

Ethics approval and consent to participate

Not applicable.

Consent for publication

Not applicable.

Author contributions

Jeffrey Larnard: Conceptualization; Investigation; Writing – original draft; Writing – review & editing.

Kyleen Swords: Writing – original draft; Writing – review & editing.

Dan Taupin: Conceptualization; Writing – review & editing.

Simi Padival: Conceptualization; Writing – review & editing.

Acknowledgements

Not applicable.

Funding

The authors received no financial support for the research, authorship, and/or publication of this article.

Competing interests

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Availability of data and materials

Not applicable.

ORCID iD

Jeffrey Larnard  <https://orcid.org/0009-0004-1971-2961>

References

1. Rucker RW and Harrison GM. Outpatient intravenous medications in the management of cystic fibrosis. *Pediatrics* 1974; 54: 358–360.
2. Paladino JA and Poretz D. Outpatient parenteral antimicrobial therapy today. *Clin Infect Dis* 2010; 51(Suppl. 2): S198–S208.
3. 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.
4. Shah A, Petrak R, Fliegelman R, *et al.* Infectious diseases specialty intervention is associated with better outcomes among privately insured individuals receiving outpatient parenteral antimicrobial therapy. *Clin Infect Dis* 2019; 68: 1160–1165.
5. Norris AH, Shrestha NK, Allison GM, *et al.* 2018 Infectious Diseases Society of America clinical practice guideline for the management of outpatient parenteral antimicrobial therapy. *Clin Infect Dis* 2019; 68: 1–4.
6. Quick Facts United States. United States Census Bureau. Updated 1 July 2022. <https://www.census.gov/quickfacts/fact/table/US/PST045221> (accessed 4 January 2023).
7. Fast Facts United States Health Systems Infographic. American Hospital Association. Updated 2020. <https://www.aha.org/infographics/2021-01-15-fast-facts-us-health-systems-infographic> (accessed 4 January 2023).
8. Crowley R, Daniel H, Cooney TG, *et al.* Envisioning a better U.S. health care system for all: coverage and cost of care. *Ann Intern Med* 2020; 172(2 Suppl.): S7–S32.
9. Galvani AP, Parpia AS, Foster EM, *et al.* Improving the prognosis of health care in the USA. *Lancet* 2020; 395: 524–533.
10. Payers in the Health Care Industry. Collective Medical. <https://collectivemedical.com/resources/payers/> (accessed 4 January 2023).
11. Keller S, Pronovost P and Cosgrove S. What Medicare is missing. *Clin Infect Dis* 2015; 61: 1890–1891.
12. Hamad Y, Lane MA, Beekmann SE, *et al.* Perspectives of United States-based infectious diseases physicians on outpatient parenteral antimicrobial therapy practice. *Open Forum Infect Dis* 2019; 6: ofz363.
13. Lane MA, Marschall J, Beekmann SE, *et al.* Outpatient parenteral antimicrobial therapy practices among adult infectious disease physicians. *Infect Control Hosp Epidemiol* 2014; 35: 839–844.
14. Berrevoets MAH, Ten Oever J, Oerlemans AJM, *et al.* Quality indicators for appropriate outpatient parenteral antimicrobial therapy in adults: a systematic review and RAND-modified Delphi procedure. *Clin Infect Dis* 2020; 70: 1075–1082.
15. Mansour O, Heslin J and Townsend JL. Impact of the implementation of a nurse-managed outpatient parenteral antibiotic therapy (OPAT) system in Baltimore: a case study demonstrating cost savings and reduction in re-admission rates. *J Antimicrob Chemother* 2018; 73: 3181–3188.
16. Rivera CG, Mara KC, Mahoney MV, *et al.* Survey of pharmacists on their roles and perceptions of outpatient parenteral antimicrobial therapy in the United States. *Antimicrob Steward Healthc Epidemiol* 2022; 2: e69.
17. Keller SC, Cosgrove SE, Arbaje AI, *et al.* It's complicated: patient and informal caregiver performance of outpatient parenteral antimicrobial therapy-related tasks. *Am J Med Qual* 2020; 35: 133–146.
18. 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.
19. Barr DA, Semple L and Seaton RA. Self-administration of outpatient parenteral antibiotic therapy and risk of catheter-related adverse events: a retrospective cohort study. *Eur J Clin Microbiol Infect Dis* 2012; 31: 2611–2619.
20. Seetoh T, Lye DC, Cook AR, *et al.* An outcomes analysis of outpatient parenteral antibiotic therapy (OPAT) in a large Asian cohort. *Int J Antimicrob Agents* 2013; 41: 569–573.
21. Mansour O, Arbaje AI and Townsend JL. Patient experiences with outpatient parenteral antibiotic therapy: results of a patient survey comparing skilled nursing facilities and home infusion. *Open Forum Infect Dis* 2019; 6: ofz471.
22. Schmidt M, Hearn B, Gabriel M, *et al.* Predictors of unplanned hospitalization in patients receiving

- outpatient parenteral antimicrobial therapy across a large integrated healthcare network. *Open Forum Infect Dis* 2017; 4: ofx086.
23. Kaul CM, Haller M, Yang J, *et al.* Assessment of risk factors associated with outpatient parenteral antimicrobial therapy (OPAT) complications: a retrospective cohort study. *Antimicrob Steward Healthc Epidemiol* 2022; 2: e183.
 24. Suzuki J, Johnson J, Montgomery M, *et al.* Outpatient parenteral antimicrobial therapy among people who inject drugs: a review of the literature. *Open Forum Infect Dis* 2018; 5: ofy194.
 25. Fanucchi L, Leedy N, Li J, *et al.* Perceptions and practices of physicians regarding outpatient parenteral antibiotic therapy in persons who inject drugs. *J Hosp Med* 2016; 11: 581–582.
 26. Fanucchi LC, Walsh SL, Thornton AC, *et al.* Outpatient parenteral antimicrobial therapy plus buprenorphine for opioid use disorder and severe injection-related infections. *Clin Infect Dis* 2020; 70: 1226–1229.
 27. Price CN, Solomon DA, Johnson JA, *et al.* Feasibility and safety of outpatient parenteral antimicrobial therapy in conjunction with addiction treatment for people who inject drugs. *J Infect Dis* 2020; 222(Suppl. 5): S494–S498.
 28. Vazquez Deida AA, Shihadeh KC, Preslaski CR, *et al.* Use of a standardized dalbavancin approach to facilitate earlier hospital discharge for vulnerable patients receiving prolonged inpatient antibiotic therapy. *Open Forum Infect Dis* 2020; 7: ofaa293.
 29. Rappo U, Puttagunta S, Shevchenko V, *et al.* Dalbavancin for the treatment of osteomyelitis in adult patients: a randomized clinical trial of efficacy and safety. *Open Forum Infect Dis* 2018; 6: ofy331.
 30. Scoble PJ, Reilly J and Tillotson GS. Real-world use of oritavancin for the treatment of osteomyelitis. *Drugs Real World Outcomes* 2020; 7(Suppl1): 46–54.
 31. Tobudic S, Forstner C, Burgmann H, *et al.* Dalbavancin as primary and sequential treatment for gram-positive infective endocarditis: 2-year experience at the General Hospital of Vienna. *Clin Infect Dis* 2018; 67: 795–798.
 32. Cain AR, Bremmer DN, Carr DR, *et al.* Effectiveness of dalbavancin compared with standard of care for the treatment of osteomyelitis: a real-world analysis. *Open Forum Infect Dis* 2021; 9: ofab589.
 33. Wald-Dickler N, Holtom PD, Phillips MC, *et al.* Oral is the new IV. Challenging decades of blood and bone infection dogma: a systematic review. *Am J Med* 2022; 135: 369–379.e1.
 34. Mahoney MV, Childs-Kean LM, Khan P, *et al.* Recent updates in antimicrobial stewardship in outpatient parenteral antimicrobial therapy. *Curr Infect Dis Rep* 2021; 23: 24.
 35. Mahoney MV and Swords KE. Fluoroquinolones: friends or foes? *Clin Infect Dis* 2021; 73: 857–858.
 36. Seaton RA, Ritchie ND, Robb F, *et al.* From ‘OPAT’ to ‘COPAT’: implications of the OVIVA study for ambulatory management of bone and joint infection. *J Antimicrob Chemother* 2019; 74: 2119–2121.

Visit Sage journals online
[journals.sagepub.com/
 home/tai](https://journals.sagepub.com/home/tai)

 Sage journals