



Published in final edited form as:

*Am J Infect Control*. 2018 December ; 46(12): 1419–1421. doi:10.1016/j.ajic.2018.05.016.

## A new frontier: Central line-associated bloodstream infection surveillance in home infusion therapy

Sara C. Keller, MD, MPH, MSHP<sup>a,b,\*</sup>, Deborah Williams, RN, MSN, MPH<sup>c</sup>, Clare Rock, MD, MPH<sup>a,b,d</sup>, Shiv Deol, MHA<sup>c</sup>, Polly Trexler, MS, CIC<sup>d</sup>, and Sara E. Cosgrove, MD, MS<sup>a,b,d</sup>

<sup>a</sup>Department of Medicine, Division of Infectious Diseases, Johns Hopkins University School of Medicine, Baltimore, MD

<sup>b</sup>Armstrong Institute of Patient Safety and Quality, Johns Hopkins University School of Medicine, Baltimore, MD

<sup>c</sup>Johns Hopkins Home Care Group, Baltimore, MD

<sup>d</sup>Department of Hospital Epidemiology and Infection Control, Johns Hopkins Hospital, Baltimore, MD

The importance of central line-associated bloodstream infection (CLABSI) prevention has been increasingly recognized over the last 2 decades in acute care settings. National policies focusing on surveillance and reporting of CLABSIs and focusing on CLABSI prevention in acute care settings have had a major impact on patient safety in the acute care setting. Over the last 20 years, national acute care CLABSI rates have dropped up to 50%.<sup>1–4</sup>

In contrast, there has been less recognition of CLABSIs when patients go home with their central venous catheters (CVCs) for treatments such as chemotherapy, total parenteral nutrition, outpatient parenteral antimicrobial therapy, and immunoglobulin therapy. These therapies are common: currently, 1.24 million courses of home infusion therapy are delivered to 829,000 patients a year in the United States, and the market for home infusion therapy grows 8% a year.<sup>5</sup> In home infusion therapy, non-health care workers (patients and their caregivers, such as family, friends, neighbors, or even coworkers) perform day-to-day CVC care and infusions,<sup>6</sup> with training and ongoing clinical examinations from home health nurses.<sup>7</sup> However, unlike in acute care, there is no standardized definition of CLABSIs in home infusion therapy. There is no reporting platform or requirement for CLABSIs. Furthermore, barriers to CLABSI surveillance in home infusion therapy differ from those in acute care. As more home infusion agencies consider ways to perform surveillance for CLABSIs,<sup>8</sup> an understanding of the assorted challenges is necessary (Table 1).

First, the lack of a widely accepted standard definition of CLABSIs in home infusion therapy makes benchmarking across patients and agencies unreliable. In the United States, standardized surveillance definitions for CLABSIs in acute care settings exist.<sup>9,10</sup> Although

\*Address correspondence to Sara C. Keller, MD, MPH, MSHP, Division of Infectious, Diseases, Department of Medicine, Armstrong Institute of Patient Safety and Quality, Johns Hopkins University School of Medicine, 818 Halsted Building, 1600 N Wolfe, St, Baltimore, MD 21287. skeller9@jhmi.edu.

Conflicts of interest: None to report.

an Association for Professionals in Infection Control and Epidemiology/Centers for Disease Control and Prevention Health care Infection Control Practices Advisory Committee definition for home health care-associated bloodstream infections (BSIs) exists,<sup>11</sup> relying heavily on the Centers for Disease Control and Prevention's National Healthcare Safety Network (NHSN) acute care CLABSI criteria,<sup>10,11</sup> the definition is not commonly used because of a lack of generalizability of the acute care NHSN CLABSI definition to home infusion therapy. In a national survey of home infusion agencies supporting pediatric oncology patients, none followed all NHSN CLABSI criteria.<sup>12</sup> Instead, reported CLABSIs in home infusion therapy rates have ranged from 0.19–3.6 per 1,000 home treatment or catheter days.<sup>13–17</sup>

The CLABSI definition lacks critical components, including the denominator and numerator criteria. For denominator data, there is a lack of agreement as to what characterizes a home infusion catheter day, such as whether to count days when CVCs are accessed by outpatient infusion center staff and not accessed by patients. There is also disagreement around attribution of CLABSIs, for example, if a CVC is accessed by both a patient and an outpatient infusion center.<sup>8,11</sup> Many home infusion agencies only provide supplies and medications, whereas home nursing agencies provide patient and caregiver education and catheter dressing maintenance, and attribution of CLABSIs is unclear in this circumstance as well. In addition, the acute care definition of a primary BSI, secondary BSI, and contaminant may not be generalizable if a BSI is treated at an unaffiliated hospital where details about the infection are inaccessible to the home infusion agency.<sup>11</sup>

There is also a lack of benchmarking data. Although standardized infection ratios adjust rates of CLABSIs based on facility- and patient-level factors, aiming for a fairer comparison of acute care hospitals, these do not exist in home infusion therapy.<sup>18</sup> As a result, although most (97%) home infusion agencies collect CVC infection data,<sup>19</sup> they have been unable to compare their data with others. A standardized home infusion-specific CLABSI surveillance definition that is feasible to apply and relevant for this patient population is clearly needed for quality improvement efforts and for external benchmarking.<sup>8</sup>

Second, there is no reporting platform for CLABSIs in home infusion therapy. In acute care settings, CLABSIs are reported to the NHSN.<sup>10</sup> However, the NHSN is not currently configured to accept data from home health care.<sup>8</sup> In fact, the NHSN's Patients Accessing Central Lines rule, which excludes patients documented as accessing their own CVC from acute care CLABSI reporting,<sup>20</sup> excludes all home infusion therapy CLABSIs (where patients and caregivers do most CVC access).<sup>8</sup>

Third, the lack of a standard definition or reporting platform contributes to the absence of a reporting requirement for CLABSIs. In acute care, national policies have emphasized CLABSI prevention: CLABSIs are no longer reimbursed by the Centers for Medicare and Medicaid Services and CLABSI rates impact hospital reimbursement and reputation.<sup>21</sup> Although most private insurers, Medicaid programs, and military insurances cover home infusion therapy, Medicare has not fully covered home infusion therapy.<sup>22</sup> Therefore, the Centers for Medicare and Medicaid Services have not provided the same impetus and requirements to improve CLABSIs in home infusion therapy as it has in acute care. The

Joint Commission requires home infusion agencies to track complications but has not defined what this tracking entails.<sup>8,23</sup>

Finally, home infusion agencies attempting to track CLABSIs face barriers in obtaining the needed information to identify the presence of a potential CLABSI and adjudicate whether it meets a CLABSI definition. Because the agencies may not have daily contact with the patients, the first sign that a CLABSI may exist is often when a scheduler contacts a patient for supply delivery and a caregiver indicates they have been admitted for an infection. Then, because of different medical records systems at hospitals where their patients are admitted, agencies struggle to get information, including culture data and symptom documentation. With insufficient data, home infusion agencies may define CLABSIs as any positive blood culture, any physician note stating that the patient had a CLABSI, or a positive culture of a CVC tip.<sup>8</sup> Furthermore, although in acute care settings trained infection preventionists (IPs) and hospital epidemiologists perform surveillance for CLABSIs through extensive chart review and spend a significant amount of time and effort on CLABSI prevention, many home infusion agencies lack trained IPs.<sup>8</sup> Instead, some may task licensed practical nurses lacking training in surveillance with collecting data.

However, change is coming. The 21st Century Cures Act will expand Medicare coverage for home infusion therapy services by 2021.<sup>24</sup> This act will likely lead to increased pressure for home infusion therapy CLABSI surveillance.<sup>8</sup> In anticipation of this change, leadership at many home infusion therapy agencies has expressed a desire to benchmark CLABSI data.<sup>8</sup>

A transdisciplinary approach including experts in health care epidemiology, infection prevention, infusion nursing, home infusion therapy, home health nursing, and quality metric development must be tasked with development of clear surveillance definitions and benchmarking in home infusion therapy. In particular, criteria for denominator data, numerator data, and patient inclusion and exclusion criteria are needed. Suggested solutions could include broad agreement to include all home venous catheter days in denominator data and all patients receiving services from home infusion agencies in numerator data, increased collaboration with NHSN and insurers to facilitate and mandate reporting, and collaboration with acute care IPs when a patient receiving home infusion therapy is admitted to a hospital. Pressure to report these data is mounting, and ensuring the data being reported are accurate and actionable is essential. Expertise in infection prevention at home infusion agencies is also required to perform surveillance and to lead prevention efforts. Armed with these definitions, informed work to reduce CLABSIs and enhance patient safety in home infusion therapy can begin.

## Acknowledgments

We thank the Home Infusion Benchmarking Collaborative for their comments and contributions.

Funding/support: Supported by the Agency for Healthcare Research and Quality (grant no. 1K08HS025782-01 to S.C.K.) and the Society for Healthcare Epidemiology of America Epi-Program (to S.C.K.).

## References

1. Pronovost PJ, Marsteller JA, Goeschel CA. Preventing bloodstream infections: a measurable national success story in quality improvement. *HealthAff(Millwood)* 2011;30:628–34.
2. Berenholtz SM, Lubomski LH, Weeks K, Goeschel CA, Marsteller JA, Pham JC, et al. Eliminating central line-associated bloodstream infections: a national patient safety imperative. *Infect Control Hosp Epidemiol* 2014;35:56–62. [PubMed: 24334799]
3. Wise ME, Scott RD 2nd, Baggs JM, JR Edwards, Ellingson KD, Fridkin SK, et al. National estimates of central line-associated bloodstream infections in critical care patients. *Infect Control Hosp Epidemiol* 2013;34:547–54. [PubMed: 23651883]
4. National Center for Emerging and Zoonotic Infectious Diseases. National and state healthcare-associated infections progress report Atlanta, GA. 2016 Available from: <https://www.cdc.gov/hai/pdfs/progress-report/exec-summary-HAIPR.pdf>. Accessed June 1, 2018.
5. National Home Infusion Association. The NHIA industry-wide data initiative phase I: 2010 NHIA provider survey comprehensive aggregate analysis report. 2016 Available from: <http://www.nhia.org/Data/phase1.cfm>. Accessed June 1, 2018.
6. Nathwani D, Tice A. Ambulatory antimicrobial use: the value of an outcomes registry. *JAntimicrob Chemother* 2002;49:149–54. [PubMed: 11751779]
7. Gorski LA, Hadaway L, Hagle M, McGoldrick M, Orr M, Doellman D. The 2016 infusiontherapy standards of practice. *J Infus Nurs* 2016;39(Suppl):S1–159.
8. Kramer N Monitoring central line-associated bloodstream infections (CLABSI) in home infusion: preparing for industry-wide benchmarking. *Infusion* 2016;36–44.
9. Mermel LA, Allon M, Bouza E, Craven DE, Flynn P, O’Grady NP, et al. Clinical practice guidelines for the diagnosis and management of intravascular catheter- related infection: 2009 update by the Infectious Diseases Society of America. *Clin Infect Dis* 2009;49:1–45. [PubMed: 19489710]
10. Centers for Disease Control and Prevention. Centers for Disease Control and Prevention/National Healthcare Safety Network Device Associated Module. Central Line Associated Bloodstream Infection (CLABSI) Event 2015 Available from: [http://www.cdc.gov/nhsn/pdfs/pscmanual/4psc\\_clabscurrent.pdf](http://www.cdc.gov/nhsn/pdfs/pscmanual/4psc_clabscurrent.pdf). Accessed June 1, 2018.
11. Association of Professionals in Infection Control and Epidemiology. APIC-HICPAC surveillance definitions for home health care and home hospice infections. 2008 Available from: [http://www.apic.org/Resource\\_/TinyMceFileManager/Practice\\_Guidance/HH-Surv-Def.pdf](http://www.apic.org/Resource_/TinyMceFileManager/Practice_Guidance/HH-Surv-Def.pdf). Accessed June 1, 2018.
12. Rinke ML, Bundy DG, Milstone AM, Deuber K, Chen AR, Colantuoni E, et al. Bringing central line-associated bloodstream infection prevention home: CLABSI definitions and prevention policies in home health care agencies. *JtCommJ Qual Patient Saf* 2013;39:361–70.
13. Keller SC, Williams D, Gavvani M, Hirsch D, Adamovich J, Hohl D, et al. Environmental exposures and the risk of central venous catheter complications and readmissions in home infusion therapy patients. *Infect Control Hosp Epidemiol* 2016;38:68–75.
14. Ross VM, Guenter P, Corrigan ML, Kovacevich D, Winkler MF, Resnick HE, et al. Central venous catheter infections in home parenteral nutrition patients: Outcomes from Sustain: American Society for Parenteral and Enteral Nutrition’s National Patient Registry for Nutrition Care. *Am J Infect Control* 2016;44:1462–8. [PubMed: 27908433]
15. Rinke ML, Milstone AM, Chen AR, Mirski K, Bundy DG, Colantuoni E, et al. Ambulatory pediatric oncology CLABSIs: epidemiology and risk factors. *Pediatr Blood Cancer* 2013;60:1882–9. [PubMed: 23881643]
16. Moureau N, Poole S, Murdock MA, Gray SM, Semba CP. Central venous catheters in home infusion care: outcomes analysis in 50,470 patients. *JVasc Interv Radiol* 2002;13:1009–16. [PubMed: 12397122]
17. Wozniak LJ, Bechtold HM, Reyen LE, Chan AP, Marcus EA, Vargas JH. Epidemiology and risk factors for outpatient-acquired catheter-related bloodstream infections in children receiving home parenteral nutrition. *JPEN J Parenter Enteral Nutr* 2018;42:942–8. [PubMed: 29446842]

18. Centers for Disease Control and Prevention. The NHSN standardized infection ratio (SIR): a guide to the SIR. 2018 Available from: <https://www.cdc.gov/nhsn/pdfs/ps-analysis-resources/nhsn-sir-guide.pdf>. Accessed June 1, 2018.
19. Kramer N, Santaromita K, Shelton J. NHIA Industry-Wide Data Initiative Phase I 2010 NHIA Provider Survey Comprehensive Aggregate Analysis Report. Alexandria (VA): National Home Infusion Association; 2011.
20. National Healthcare Safety Network. National Healthcare Safety Network (NHSN) overview: Centers for Disease Control and Prevention. 2016 Available from: [https://www.cdc.gov/nhsn/pdfs/validation/2016/pcsmanual\\_2016.pdf](https://www.cdc.gov/nhsn/pdfs/validation/2016/pcsmanual_2016.pdf). Accessed June 1, 2018.
21. Stone PW, Glied SA, McNair PD, Matthes N, Cohen B, Landers TF, et al. CMS changes in reimbursement for HAIs: setting a research agenda. *Med Care* 2010;48:433–9. [PubMed: 20351584]
22. Keller S, Pronovost P, Cosgrove S. What Medicare is missing. *Clin Infect Dis* 2015;61:1890–1. [PubMed: 26338782]
23. The Joint Commission. Prepublication requirements: standards revision for home health agency final rule in home care-additional updates. Washinton (DC): The Joint Commission Perspectives; 2018.
24. Stramowski A House passes bill with telehealth, home infusion provisions. *Home Health Care News*. 2016 Available from: <https://homehealthcarenews.com/2016/12/house-passes-bill-with-telehealth-home-infusion-provisions/>. Accessed June 1, 2018.

**Table 1**

## Requirements for reporting CLABSIs in home infusion therapy

Current need	Example of problem	Example of possible solution
Denominator definition	Should a catheter day be counted on a day when an outpatient infusion center accesses the CVC?	All days between CVC placement or hospital discharge and CVC removal or hospital admission could be counted.
Attribution determination	Should a CLABSI be counted if the CVC is accessed both at home and in an outpatient oncology clinic?	All CLABSIs could be counted if a patient has been in their home with the CVC.
Ownership of the home infusion patient	Should a CLABSI be counted by a home infusion agency if a separate home nursing agency provides CVC-related education and nursing visits?	Home nurses specially trained in home infusion therapy could preferentially provide services to home infusion patients, and any CLABSIs affiliated with these patients counted.
SIRs	How can home infusion agencies caring for very different populations benchmark their data?	SIRs could account for risks such as patients on home parenteral nutrition and the length of time on home infusion therapy.
CLABSI reporting platform	Where can home infusion agencies report their data?	NHSN could develop a module for CLABSI in home health.
CLABSI reporting requirement	Why would a home infusion agency devote effort to surveillance?	Insurers could require reporting of CLABSIs for reimbursement.
Accessing inpatient records	How does a home infusion agency know that a patient has been admitted for a CLABSI?	Acute care IPs could provide data to home infusion agencies if a patient was admitted with a CLABSI.
Trained IPs at home infusion agencies	Few home infusion agencies hire IPs.	Hospitals and home infusion agencies could collaborate to perform surveillance.

*CLABSI*, central line-associated bloodstream infection; *CVC*, central venous catheter; *IP*, infection preventionist; *NHSN*, National Healthcare Safety Network; *SIR*, standardized infection ratio.