RESEARCH LETTER

Accuracy of Hemodialysis Bloodstream Infection Pathogen Reporting to the National Healthcare Safety Network: Results of an Academic Dialysis Program Audit

To the Editor:

Patients with dialysis-dependent end-stage kidney disease experience high rates of infections. Bloodstream infections (BSIs) are the major cause of fatal infection and third leading cause of death. Since 1999, the Centers for Disease Control and Prevention has tracked dialysis infections by facility self-reporting to the National Healthcare Safety Network (NHSN). Maintaining accurate BSI data is necessary to inform infection prevention efforts. BSI rates also affect the Patient Safety domain of the Quality Incentive Program, negatively affecting facility revenue. Therefore, facilities may be incentivized to underreport infections. A total of 13% of facilities reported no BSIs in the latest NHSN review. Although BSI rate reporting has been evaluated previously, to our knowledge, no studies have evaluated the accuracy of pathogen reporting to NHSN.

The purpose of our study was to audit pathogen data submitted to NHSN using original microbiology culture data and, if discrepancies were found, categorize their nature and prevalence. Detailed methods may be found in Item S1. Briefly, we performed a retrospective audit of a single calendar year (2016) of NHSN BSI reporting for an 11-facility hospital-owned academic dialysis program. We compared BSI events submitted to NHSN with original microbiology culture data from source laboratories for each event. Demographic, vascular access, and BSI source/cause (access-related, contaminant, etc) were obtained from NHSN submissions and dialysis medical record system (Table S1). Submitted BSI dialysis events were then categorized (Fig 1) as follows:

- Complete: Submitted report information matches species and susceptibility information from original microbiology culture data.
- Incomplete: Submitted report was missing organism or lacked provided detail. For example, a submission might specify Staphylococcus aureus but omit methicillin resistance/susceptibility though present in the microbiology report.
- Inaccurate: Submitted bacterial pathogen was different from that specified on the laboratory culture.
- Error: A BSI event was submitted when none occurred. For example, a wound culture submitted as a BSI.

Our audit identified 91 BSI events submitted to NHSN during the study period. These were associated with 102 positive blood cultures (maximum 3 cultures reported per BSI event). Summary data were consistent with prior studies of dialysis infections: 43% of BSI events were “access-related”; 77% of BSIs, regardless of source, occurred in those with central venous catheters. Staphylococcus species predominated and Gram-positive bacteria overall constituted 64% of positive cultures (Tables 1 and S2).

Further analysis showed significant discordance between submitted pathogen data and primary culture data. Overall, 64% of cultures were reported accurate and complete, and 36% were incomplete, inaccurate, or reported a BSI culture when a different infection type occurred. The most common error was incomplete reporting, affecting 22.5% of cultures. Surprisingly, 6.7% of cultures were erroneously reported: wound cultures were submitted as BSI cultures.

A number of factors may have contributed to our findings.

- Lack of a centralized BSI submission program during the study period leading to inter-center variability in submission procedures.
- Cultures performed by nonaffiliated (outside) laboratories that complicated data capture. Reporters may have relied on secondary sources such as discharge summaries for culture data.
- The inherent time lag in cultures being finalized. Submissions may have used preliminary culture data, leading to an incomplete submission.

The purpose of this study was to evaluate the fidelity of submitted NHSN events. To our knowledge, this is the first audit of NHSN dialysis BSI events using original culture data. The high error rate found has significant implications for facility and, if generalizable, wider infection control efforts. For example, a facility program targeting Staphylococcus epidermidis infections will be ineffectual if the most common pathogen is methicillin-resistant S aureus. Although incomplete data may appear a less serious error than a complete omission, this must be contextualized. For example, reporting a Klebsiella pneumoniae BSI without specifying it as carbapenemase producing would omit the presence of a multidrug-resistant potentially fatal pathogen in the dialysis unit - an unacceptable error. Also, we were surprised to find BSIs reported in error (overreporting). Facilities are incentivized to underreport yet nearly 7% of reported dialysis BSI cultures did not occur. This may have led to unwarranted financial penalties.

Validating our findings at scale would have a significant impact on national infection control efforts but is hampered by a lack of a microbiology laboratory data sharing system. Manually obtaining culture data from hundreds or thousands of disparate laboratories would require a massive and costly effort. We believe policymakers should advocate for a national dialysis BSI reporting system in which automated culture data are sourced directly from laboratories to a national clearinghouse. This would effectively eliminate underreporting (and overreporting), improve pathogen reporting accuracy, and
remove facilities from the conflict of interest inherent in self-reporting.

Finally, our study has limitations. Notably, the small sample size significantly hampers generalizability. We were unable to assess underreporting due to lack of BSI claims data from insurers as a comparator. The relatively brief single-year study period is also a limitation.

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SUPPLEMENTARY MATERIAL
Supplementary File (PDF)
Item S1. Detailed methods
Table S1. Patient demographics
Table S2. Verified pathologies of bloodstream infections

Figure 1. Visual representation of methods. Simple arrows represent the sequence of steps in the procedure for the methods by the investigators (left) and the system of reporting by the dialysis centers (right). Abbreviations: BSI, bloodstream infection; lab, laboratory; NHSN, National Healthcare Safety Network.

ARTICLE INFORMATION
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**Table 1.** Verified Pathologies of BSIs: Survey of Confirmed BSI Events Occurring in the Sample Population in 2016

| True Pathology                        | Central Venous Catheter | Arteriovenous Fistula | Arteriovenous Graft | Total Positive Cultures by Pathology |
|---------------------------------------|-------------------------|-----------------------|---------------------|-------------------------------------|
| *Staphylococcus aureus* (uncharacterized) | 6 (5.88%)               | 1 (0.98%)             | 0 (0.0%)            | 7 (6.86%)                          |
| Methicillin-resistant *S aureus*      | 7 (6.86%)               | 1 (0.98%)             | 1 (0.98%)           | 9 (8.82%)                           |
| Methicillin-susceptible *S aureus*    | 7 (6.86%)               | 2 (1.96%)             | 0 (0.0%)            | 9 (8.82%)                           |
| Other *Staphylococcus* spp            | 19 (18.63%)             | 10 (9.80%)            | 1 (0.98%)           | 30 (29.41%)                        |
| *Streptococcus* spp.                  | 5 (4.90%)               | 3 (2.94%)             | 1 (0.98%)           | 9 (8.82%)                           |
| Other Gram-positive spp               | 18 (17.65%)             | 2 (1.96%)             | 1 (0.98%)           | 21 (20.6%)                          |
| Other Gram-negative spp               | 10 (9.80%)              | 5 (4.9%)              | 2 (1.96%)           | 17 (16.87%)                         |
| Total positive cultures by access site| 72 (70.59%)             | 24 (23.53%)           | 6 (5.88%)           | 102 (1.0%)                          |

**Note:** Further species characterization detail can be found in online Table S2. Abbreviation: BSI, bloodstream infection.

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