

## Bloodstream Infection Rates in Outpatient Hemodialysis Facilities Participating in a Collaborative Prevention Effort: A Quality Improvement Report

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**Background:** Bloodstream infections (BSIs) cause substantial morbidity in hemodialysis patients. In 2009, the US Centers for Disease Control and Prevention (CDC) sponsored a collaborative project to prevent BSIs in outpatient hemodialysis facilities. We sought to assess the impact of a set of interventions on BSI and access-related BSI rates in participating facilities using data reported to the CDC's National Healthcare Safety Network (NHSN).

**Study Design:** Quality improvement project.

**Setting & Participants:** Patients in 17 outpatient hemodialysis facilities that volunteered to participate.

**Quality Improvement Plan:** Facilities reported monthly event and denominator data to NHSN, received guidance from the CDC, and implemented an evidence-based intervention package that included chlorhexidine use for catheter exit-site care, staff training and competency assessments focused on catheter care and aseptic technique, hand hygiene and vascular access care audits, and feedback of infection and adherence rates to staff.

**Outcomes:** Crude and modeled BSI and access-related BSI rates.

**Measurements:** Up to 12 months of preintervention (January 2009 through December 2009) and 15 months of intervention period (January 2010 through March 2011) data from participating centers were analyzed. Segmented regression analysis was used to assess changes in BSI and access-related BSI rates during the preintervention and intervention periods.

**Results:** Most (65%) participating facilities were hospital based. Pooled mean BSI and access-related BSI rates were 1.09 and 0.73 events per 100 patient-months during the preintervention period and 0.89 and 0.42 events per 100 patient-months during the intervention period, respectively. Modeled rates decreased 32% ( $P = 0.01$ ) for BSIs and 54% ( $P < 0.001$ ) for access-related BSIs at the start of the intervention period.

**Limitations:** Participating facilities were not representative of all outpatient hemodialysis centers nationally. There was no control arm to this quality improvement project.

**Conclusions:** Facilities participating in a collaborative successfully decreased their BSI and access-related BSI rates. The decreased rates appeared to be maintained in the intervention period. These findings suggest that improved implementation of recommended practices can reduce BSIs in hemodialysis centers.

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**INDEX WORDS:** Dialysis; infection control; bacteremia; quality improvement; catheter-related infections; vascular access devices.

In 2010, more than 370,000 persons received maintenance hemodialysis in the United States for chronic kidney failure.<sup>1</sup> Bloodstream infections (BSIs) are an important cause of morbidity in this population. The rate of hospitalizations for bacteremia or septic-

mia among maintenance hemodialysis patients was 116 events per 1,000 patient-years in 2010 and has increased 51% since 1993.<sup>1</sup> Hemodialysis patients are particularly susceptible to BSIs because of their need for vascular access, typically through arteriovenous

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(AV) fistulas or grafts or central venous catheters (CVCs). Hemodialysis patients with CVCs have a much higher risk of acquiring a BSI compared with those with AV fistulas or grafts.<sup>2-6</sup> Approximately 37,000 vascular access–related BSIs are estimated to have occurred in US hemodialysis patients with a CVC in 2008,<sup>7</sup> with an average cost per hospitalization of ~\$23,000.<sup>8</sup> These represent a large portion of all catheter-related BSIs in the nation, thereby constituting an important target for intervention.<sup>7</sup> Fistula- and graft-related BSIs also contribute to the overall BSI burden in this population, although to a lesser extent.

Preventing CVC- and other vascular access–related BSIs in hemodialysis patients has been identified as a national priority by the US Department of Health and Human Services.<sup>9</sup> Several initiatives have demonstrated the ability to reduce CVC-associated BSIs in intensive care unit patient populations.<sup>10-12</sup> There have been few similar initiatives attempted on a large scale in outpatient hemodialysis centers. In April 2009, the US Centers for Disease Control and Prevention (CDC) announced plans for a collaborative project to prevent BSIs and invited outpatient hemodialysis centers to participate. We assessed changes in BSI rates over time in the group of facilities that joined the CDC Dialysis BSI Prevention Collaborative in 2009, using data reported to the National Healthcare Safety Network (NHSN).

## METHODS

### CDC Dialysis BSI Prevention Collaborative and Interventions

Participation in the CDC Dialysis BSI Prevention Collaborative project (the Collaborative) was voluntary and open to any US outpatient hemodialysis facility. Core activities of the Collaborative included participation in the CDC's NHSN surveillance system, implementation of the Collaborative interventions, and participation in monthly conference calls and yearly in-person meetings. The CDC provided participant training and assistance on NHSN enrollment and reporting procedures. Participants were expected to track and report infections to NHSN in a uniform manner, following the definitions described in the Dialysis Event Surveillance Protocol.<sup>13</sup> The 3 event types that were reported to NHSN were positive blood culture results, intravenous antimicrobial administration starts, and hospitalizations. Participants also were required to complete the NHSN Outpatient Dialysis Center Practices Survey.

At an in-person meeting held in July 2009, CDC subject matter experts shared with the Collaborative participants the evidence supporting various recommended practices for BSI prevention and participants voted on the interventions they believed should be included in the Collaborative. During the next several months, a working group that consisted of CDC staff, experts from outside the CDC, and representatives of 3 Collaborative facilities further defined the proposed interventions; these then were presented to all Collaborative members for discussion and final approval. The resultant "intervention package" (Box 1) included a standard measurement system, evidence-based recommendations from CDC guidelines, staff practice audits with feedback of results, and

### Box 1. CDC Dialysis BSI Prevention Collaborative Interventions

#### Core Interventions

*Surveillance & feedback using NHSN:* Conduct monthly surveillance for BSIs and other dialysis events and enter events into CDC's NHSN. Calculate facility rates and compare to rates in other facilities using NHSN. Actively share results with front-line clinical staff.

*Chlorhexidine for skin antisepsis:* Use a chlorhexidine (>0.5%) with alcohol solution as first-line agent for skin antisepsis, particularly for central catheter insertion & during dressing changes. Povidone-iodine, preferably with alcohol, or 70% alcohol are alternatives.

*Hand hygiene surveillance:* Perform monthly hand hygiene audits with feedback of results to clinical staff.

*Catheter/vascular access care observations:* Perform quarterly audits of vascular access care & catheter accessing to ensure adherence to recommended procedures. This includes aseptic technique while connecting & disconnecting catheters and during dressing changes. Share results with front-line clinical staff.

*Patient education/engagement:* Provide standardized education to all patients on infection prevention topics including vascular access care, hand hygiene, risks related to catheter use, recognizing signs of infection, and instructions for access management when away from dialysis unit.

*Staff education & competency:* Provide regular training of staff on infection control topics, including access care & aseptic technique. Perform competency evaluation for skills such as catheter care and accessing at least every 6-12 mo and upon hire.

*Catheter reduction:* Incorporate efforts (eg, through patient education, vascular access coordinator) to reduce catheters by identifying barriers to permanent vascular access placement & catheter removal.

#### Supplemental Intervention

*Antimicrobial ointment or chlorhexidine-impregnated sponge dressing:* Apply bacitracin/gramicidin/polymyxin B ointment or povidone-iodine ointment to catheter exit sites during dressing change or use a chlorhexidine-impregnated sponge dressing.

Abbreviations: BSI, bloodstream infection; CDC, Centers for Disease Control and Prevention; NHSN, National Healthcare Safety Network.

education of staff. When the intervention package was defined, participants were encouraged to begin implementing the interventions in their respective facilities. Audit tools and other materials also were generated and distributed to support intervention implementation.<sup>14</sup>

Collaborative conference calls and in-person meetings presented opportunities for participants to learn about infection prevention topics from subject matter experts and network with other motivated dialysis providers, describe implementation challenges and strategies, and share experiences and success stories. Participants were provided status updates indicating the group's progress toward reporting to NHSN and data feedback reports documenting dialysis event rates for their individual facility, the overall Collaborative, and all dialysis facilities reporting to NHSN.

#### Measure Definition

The NHSN Dialysis Event Surveillance Protocol defines a BSI as a positive blood culture collected from a hemodialysis patient as an outpatient or within 1 calendar day after a hospital admission.<sup>13</sup> Among BSIs, the suspected source of the positive blood culture

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