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## Brief report

## Dialysis Event Surveillance Report: National Healthcare Safety Network data summary, January 2007 through April 2011

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## Key Words:

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A total of 24,092 adverse events in hemodialysis outpatients during January 2007 through April 2011 were reported to the National Healthcare Safety Network. Of 2,656 bloodstream infections, 67.3% were in patients with central venous catheters. For all events, rates associated with central venous catheters were higher than for other vascular access types.

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## BACKGROUND

More than 400,000 persons in the United States require hemodialysis for end stage renal disease (ESRD).<sup>1</sup> The frequent need for hemodialysis vascular access via central venous catheters (CVCs), arteriovenous (AV) fistulas, or AV grafts puts patients at risk for acquiring vascular access infections, including bloodstream infections (BSIs). Although the exact burden is unknown, 37,000 central line-associated BSIs were estimated among hemodialysis outpatients in 2008.<sup>2</sup> The US Department of Health and Human Services has prioritized prevention of intravascular infection in ESRD patients, and national surveillance for these infections as a means to facilitate prevention and evaluate progress.<sup>3</sup>

The National Healthcare Safety Network (NHSN) is a widely used system for tracking health care-associated infections housed at the Centers for Disease Control and Prevention. The Dialysis Event (DE) Surveillance module within NHSN is the successor system to the Dialysis Surveillance Network (DSN).<sup>4-6</sup> DSN was initiated in 1999 as a voluntary Internet-based system for reporting infections and other hemodialysis-related adverse events. In 2005, DSN transitioned into NHSN and became known as DE Surveillance. Freestanding and hospital-based outpatient dialysis clinics that provide in-center hemodialysis are eligible to report events to NHSN.

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The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.

Conflicts of Interest: None to report.

In 2012, the Centers for Medicare and Medicaid Services incentivized reporting to NHSN by dialysis centers through their ESRD Quality Incentive Program.<sup>7</sup> This action drastically increased the number of facilities reporting to NHSN and may have changed the nature and primary purpose of reporting. We summarized dialysis event data reported to NHSN before the ESRD Quality Incentive Program.

## METHODS

Participating centers monitored their hemodialysis outpatients for 3 event types that prompt a report: an overnight hospital stay, intravenous (IV) antimicrobial start, or positive blood culture.<sup>6</sup> Multiple events could occur and be reported concurrently. For any given patient, positive blood cultures were reportable if  $\geq 21$  days had elapsed since the last reported positive blood culture, and IV antimicrobial starts were reportable if  $\geq 21$  days had elapsed since IV antimicrobial agents were last administered. For positive blood culture, users indicated the suspected source (the vascular access, another source, contamination, or uncertain) and listed 1 to 3 organisms isolated and their antimicrobial susceptibilities. For IV antimicrobial starts, users indicated if vancomycin was administered. For all events, users submitted clinical data, including the patient's vascular access types at the time of the event (ie, temporary or permanent central line, AV fistula, AV graft, and/or port device) and whether there was evidence of pus, redness, or swelling at the vascular access site. For patients with  $\geq 1$  vascular access type, events were attributed to the highest risk vascular access (with risk of temporary central line > permanent central line > port > graft > fistula). Monthly denominator data consisted of the number of hemodialysis outpatients treated in-center on the first 2 working days of the month, classified by highest risk vascular access type.

In June 2011, the DE Surveillance module was modified. In response to user feedback about data collection burden, hospitalization was removed as a DE and was replaced by a separate event type indicating evidence of potential infection at the vascular access site. We analyzed DE data for January 2007 through April 2011, a period after the last published data summary and before the change to DE Surveillance.

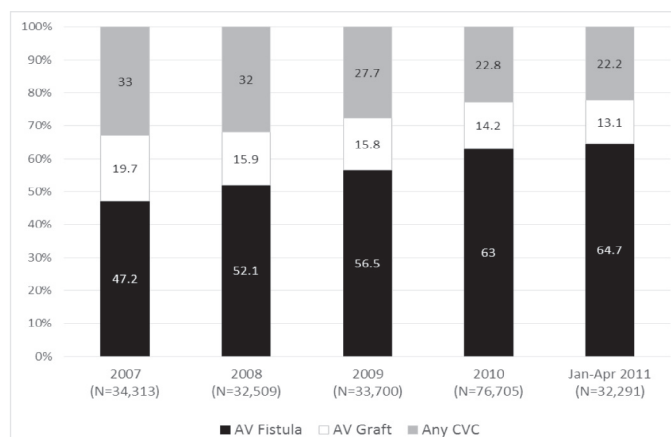
Only data following the NHSN protocol were included in analysis. Pooled mean rates were calculated and expressed per 100 patient-months. Rates for each participating facility were determined, and the rate distribution was generated. Percentiles were reported on the basis of the individual facility rates. All reported pathogens (up to 3 per blood culture) and their antimicrobial susceptibilities were included. Analysis was performed using SAS version 9.2. (SAS Institute, Cary, NC).

## Definitions

Permanent central lines were redefined in NHSN as tunneled central lines. Temporary central lines were redefined as nontunneled central lines. Because few events involved nontunneled central lines or ports, we created the combined category, "any CVC," defined as a tunneled or nontunneled central line or a port. BSI was defined as any positive blood culture. Access-related BSI was a BSI where the suspected source was the vascular access or uncertain. A local access infection was defined as an IV antimicrobial agent start or hospitalization with pus, redness, or swelling of the vascular access site reported, in the absence of an access-related BSI. A vascular access infection was defined as any access-related BSI or local access infection.

## RESULTS

Dialysis events during January 1, 2007-April 30, 2011, were reported to NHSN by 193 facilities from 28 states. Fifty-three (27%) of these were hospital-based facilities. The median reporting duration was 14 months (range, 1-52 months). A total of 24,092 events and 209,518 patient-months were reported. The most common event type was hospitalization ( $n = 18,276$ ), followed by IV antimicrobial starts ( $n = 6,529$ ), and then BSIs ( $n = 2,656$ ) (Table 1). Overall denominator data included 121,409 (57.9%) AV fistula patient-months, 55,774 (26.6%) any CVC patient-months, and 32,335 (15.4%) AV graft patient-months; however, this distribution appeared to change over time (Fig 1).



**Fig 1.** Percent of all patient-months, reported by vascular access type and year. AV, arteriovenous; CVC, central venous catheter.

Only 2.3% of reported patient-months were in nontunneled CVC patients.

Rates of all events were highest in patients with CVCs, compared with patients with AV fistulas or grafts (Table 1). The overall pooled mean rate of BSIs was 1.27 per 100 patient-months; the rate was 3.21 per 100 patient-months in any CVC patients, and 0.48 per 100 patient-months in AV fistula patients. Of the 2,656 BSIs reported, 1,788 (67.3%) were in patients with a CVC and 1,852 (69.7%) were categorized as access-related BSIs. By vascular access type, 47.6% of AV fistula BSIs, 58.4% of AV graft BSIs, and 78.7% of CVC BSIs were considered access-related. The overall rate of IV antimicrobial starts was 3.12 per 100 patient-months; the rate in all CVC patients was 6.28 per 100 patient-months and in AV fistula patients was 1.84 per 100 patient-months. Vancomycin was used in 4,694 (71.9%) of all IV antimicrobial starts reported.

## Blood isolates and antimicrobial resistance

Among the 2,656 BSIs, there were 3,656 isolated organisms reported. Coagulase-negative staphylococci and *Staphylococcus aureus* collectively accounted for 59.6% of isolated organisms (Table 2). By class, 2,721 (74.4%) of isolates were gram-positive cocci, 807 (22.1%) were gram-negative bacilli, 89 (2.4%) were gram-positive bacilli, 31 (0.9%) were fungi, 6 (0.2%) were gram-negative cocci, and 2 (0.1%) were other organisms.

Among blood isolates with relevant susceptibility results reported, 46% of *S aureus* were methicillin-resistant, 19% of *Enterococcus* spp were vancomycin-resistant, 9% of *Escherichia coli* were resistant to third-generation cephalosporins, and 9% of *Klebsiella* spp were resistant to carbapenems (Table 3).

## DISCUSSION

Actively monitoring infections and comparing facility-specific rates to aggregate rates is a recommended part of BSI prevention strategies for dialysis centers, and might by itself, stimulate practice improvements.<sup>8,9</sup> In this summary of infection-related surveillance data from a large number of outpatient dialysis centers, we found that rates of all event types were highest in CVC patients. Compared with patients with AV fistulas, CVC patients had event rates that were 7-11 times greater for BSIs and access-related BSIs, 6-8 times greater for local access infections and vascular access infections, and 3-4 times greater for IV antimicrobial and IV vancomycin starts. CVC patients also experienced the greatest burden of these events. This increased infection rate and burden has been identified previously,<sup>5,6,10</sup> and suggests that hemodialysis patients with CVCs should be prioritized for BSI and other infection prevention efforts. The range of rates across facilities within each stratum suggests important opportunities for vascular access infection prevention.

Based on our denominator analysis, the vascular access distribution at participating centers appears to have changed over time. This is consistent with national data demonstrating reductions in CVC use and increases in AV fistula use that are likely to beneficially influence overall infection rates.<sup>11</sup> Also consistent with other reports, we found that gram-positive organisms were isolated from most blood cultures.<sup>6,10</sup> Coagulase-negative staphylococci were most frequently reported; however, because participants are asked to report all positive blood cultures, including contaminants, many of these might not have been true pathogens. All positive blood cultures are reportable and are included in the BSI definition. The BSI measure was designed to be relatively simple to apply in outpatient dialysis centers that typically lack staff with infection

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