

OREGON PUBLIC HEALTH DIVISION • OREGON HEALTH AUTHORITY

CENTRAL LINE-ASSOCIATED BLOODSTREAM INFECTIONS

Central line-associated bloodstream infections (CLABSIs) are among the most commonly reported healthcare-associated infections (HAIs).¹ They are also among the most deadly, with an estimated attributable mortality of 15%–25%, and the most costly: a typical episode is associated with excess costs of \$16,550 and 24 more days in the hospital.^{2–4} A growing body of evidence suggests that these lethal and expensive infections may be entirely preventable; regional initiatives have demonstrated sustained reductions of up to 70% in CLABSI incidence in intensive-care units (ICU).^{5,6} The Centers for Disease Control and Prevention (CDC) Division of Healthcare Quality Promotion estimates that 18,000 CLABSI occurred in ICU settings in 2009, representing a 58% reduction from the 43,000 estimated for 2001.²

In response to public demand for transparency and accountability, 29 states and the District of Columbia have mandated the public reporting of HAI.⁷ Oregon joined this cohort in 2007 with the passage of House Bill 2527, which assigned the Office for Oregon Health Policy and Research (OHPR) with oversight of a statewide HAI reporting program, and which established a Health Care Acquired Infections Advisory Committee to recommend health outcomes and processes to be reported. Weighing morbidity, mortality, preventability, and the anticipated workload associated with reporting, the Committee selected ICU-associated CLABSIs as one of six reporting measures required of Oregon's acute care hospitals, effective January 2009. The Oregon Public Health Division (OPHD) seeks to ensure that the reported data are valid, consistent, and reliable. This issue of the *CD Summary* details what we know about CLABSIs in Oregon.

REPORTING CLABSIs

HB2527 required reporting by all Oregon hospitals with ICUs. These hospitals range in size from 21–534 staffed beds and represent diverse geographic regions, patient populations, and available resources. Infection data are reported by facility staff, giving rise to concerns that high reported rates could reflect aggressive case finding or sophisticated medical records technology rather than high incidence. Oregon, along with most states, opted for reporting via CDC's National Healthcare Safety Network (NHSN), because 1) it's web-accessible; 2) it offers standardized data-collection protocols, training modules, and surveillance case definitions; and 3) it's paid for by the feds. However, use of NHSN raises some concerns about data validity: several studies have demonstrated the potential for disparate interpretations of the case definitions, and reports from other states have suggested that >50% of ICU CLABSIs may be misclassified.^{8,9} Recognizing these concerns, the HAI Advisory Committee included data validation among the program's key activities.

VALIDATION OF CLABSI DATA

In 2010, a team from OPHD visited each of the 44 hospitals included in Oregon's CLABSI reporting mandate and reviewed the medical records of patients known to have had a positive blood culture and to have spent time in ICU to determine which cases met NHSN case definitions. At the 37 hospitals that reported ≤60 positive blood cultures for the year, we reviewed all of these cultures (i.e., whether reported as CLABSI or not) to determine which met the definition for ICU-acquired CLABSI. At the 7 hospitals that reported >60 positive blood cultures from ICU patients, we reviewed a sample of those *not* reported as CLABSIs, along with all that were reported as CLABSIs. At all facilities, we were blinded as to which septic events had been reported as CLABSIs. Following each visit, all cases with discordant

CLABSI determinations were reviewed with hospital staff before final status was assigned.

Results of the validation project are displayed in the table. OPHD agreed with reporting facilities in 782 of (96%) of the 817 reviewed cases. Prior to validation, hospitals had reported a total of 76 CLABSIs. After review and follow-up discussion, we determined that, prior to validation, 6 CLABSIs had been over-reported and estimated that 27 ICU CLABSIs had been unreported. Therefore, the sensitivity of hospital reporting was 72%, and the specificity was 99%. Eight percent of all positive blood cultures in ICU patients were true ICU-attributable CLABSIs. The pathogens most frequently associated with ICU CLABSIs were *Candida* spp. and coagulase-negative staphylococci (see Figure, *verso*).

Table. Estimated number of CLABSIs among ICU patients with positive blood cultures, by initial hospital report, Oregon, 2009

CLABSI		Final Determination		Total
		Present	Absent	
Hospital Report	Present	70	6	76
	Absent	27 ^a	1,089 ^a	1,116
Total		97 ^a	1,095 ^a	1,192

^a Estimated based on sampling fraction

Based on the validation findings, we now estimate a rate of 1.54 infections per 1,000 central-line days — lower than the national (non-validated) pooled mean ICU CLABSI rate of 1.65.

100% PREVENTABLE?

Oregon's relatively low ICU CLABSI incidence and the recently observed reduction in national rates are encouraging; but much work remains, especially outside the ICU. The risk of CLABSI in hemodialysis settings, for instance, merits special concern as that patient population grows.

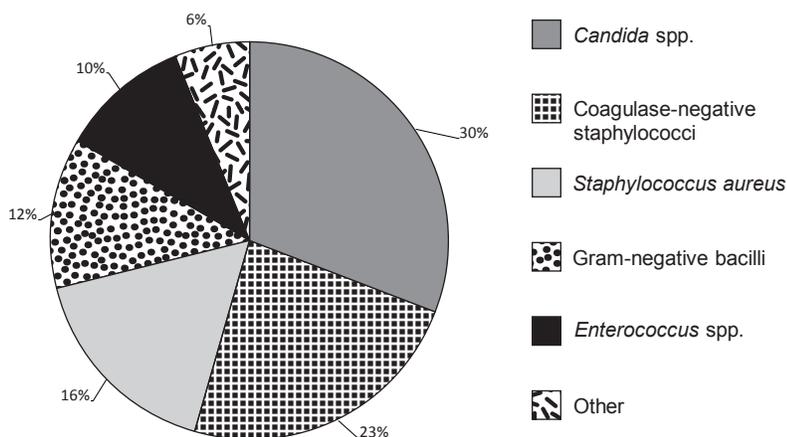
A comprehensive analysis released in 2011 by CDC examined the changing epidemiology of CLABSI in the United States by pathogen and infection setting.² The authors suggested that greater reductions observed in ICU than in other settings



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Figure. Organisms causing CLABSIs, Oregon ICUs, 2009 (n=86^b)



^b Including 70 CLABSIs correctly reported prior to validation and 16 previously unreported CLABSIs identified upon OPHD review.

may be attributable to the widespread adoption of ICU-targeted central-line insertion guidelines which include adequate skin antisepsis, proper site selection, hand hygiene, maximal sterile barrier precautions, and use of catheter insertion kits. They also noted greater reductions in CLABSIs caused by *Staphylococcus aureus* and other skin-associated organisms than in infections with other pathogens, indicating that interventions focused on line insertion may have had more success than those aimed at line maintenance.* The authors recommended that hospitals and healthcare systems improve implementation of post-insertion line-maintenance practices, develop strategies to ensure prompt removal of unneeded central lines, and take steps to reduce central line use in hemodialysis. They also recommend-

*...or perhaps that some CLABSIs had little to do with the central line?

ed enhanced surveillance for antibiotic-resistant pathogens, which are associated with greater mortality.

Nationally, the incidence of CLABSI has decreased steadily in the context of increased leadership and financial support for patient safety, the widespread adoption of best-practice “bundles” for infection prevention, inter-agency research partnerships, and ongoing clinician education. This success cannot be ascribed to any single intervention or strategy, but has resulted from interdisciplinary commitment to a culture of patient safety. Further progress toward HAI elimination will require sustained commitment.

FOR MORE INFORMATION

- Oregon healthcare acquired infections reports. Available at www.oregon.gov/OHA/OHPR/HAI_Report.shtml.
- CDC. HICPAC guidelines for the prevention of intravascular catheter-related infections, 2011. Available at

www.cdc.gov/hicpac/pdf/guidelines/bsi-guidelines-2011.pdf.

- CDC Guide to infection prevention for outpatient settings: minimum expectations for safe care. Available at www.cdc.gov/HAI/settings/outpatient/outpatient-care-guidelines.html.

REFERENCES

1. Klevens RM, Edwards JR, Richards C, Jr, et al. Estimating health care-associated infections and deaths in US hospitals, 2002. *Public Health Reports* 2007;122:160–6.
2. CDC. Vital Signs: Central line-associated blood stream infections — United States, 2001, 2008, and 2009. *MMWR* 2011;60:243–8.
3. Scott R. The direct medical costs of healthcare-associated infections in US hospitals and the benefits of prevention. Centers for Disease Control and Prevention. Available at www.cdc.gov/ncidod/dhqp/pdf/Scott_CostPaper.pdf. Accessed 15 Jan 2012.
4. Pittet D, Tarara D, Wenzel RP. Nosocomial bloodstream infection in critically ill patients: excess length of stay, extra costs and attributable mortality. *JAMA* 1994; 271:1598–601.
5. CDC. Reduction in central line-associated bloodstream infections among patients in intensive care units – Pennsylvania, April 2001–March 2005. *MMWR* 2005; 54:1013–6.
6. Pronovost P, Needham D, Berenholtz S, et al. An intervention to decrease catheter-related bloodstream infections in the ICU. *N Engl J Med* 2006; 355:2725–32.
7. Association for Professionals in Infection Control and Epidemiology. HAI reporting laws and regulations: States that have enacted laws related to reporting of healthcare-associated infections. Available at http://apic.org/Resource/TinyMceFileManager/Advocacy-PDFs/HAI_map.gif. Accessed 15 Jan 2012.
8. Mayer J, et al. Assessing inter-rater reliability of surveillance decisions by infection preventionists. Presented at Fifth Decennial Conference on Healthcare-Associated Infections, Atlanta, GA, 2010.
9. Backman LA, Melchreit R, Rodriguez R. Validation of the surveillance and reporting of central line-associated bloodstream infection data to a state health department. *Am J Infect Control* 2010; 38:832–8.