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Utilizing new subdefinitions to improve the identification of preventable central-line–associated bloodstream infections (CLABSIs)

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To the Editor—The Hospital-Acquired Conditions (HACs) Initiative in 2008 identified CLABSIs as preventable "never events" that would not be reimbursed by Medicare.[1] However, the National Healthcare Safety Network (NHSN) definition for CLABSI is broad and likely leads to overestimates of preventable CLABSIs.[2] This definition does not take into account patients who have unpreventable, noninfectious etiologies for bacteremia, such as advanced obstructive biliary malignancies.[3] We sought to evaluate the number of CLABSIs that were realistically preventable at our institution.

To accomplish this aim, 2 experienced infectious diseases physicians (D.Z.U. and A.dS.M.) reviewed all CLABSI cases that met standard NHSN definitions from 2019–2021 at the University of California, Los Angeles, which consists of 2 hospitals. Based on their expert opinions, CLABSIs were classified into 3 categories: (1) end-of-life CLABSIs (EOL CLABSIs), which were CLABSIs caused by underlying disease processes in patients who were at the end of their lives due to an advanced comorbidity; (2) definition-based (dCLABSIs), which met the NHSN definition for a CLABSI but, based on the pathogen and the clinical situation, were related to factors unrelated to end of life or the patient's central line; and (3) preventable CLABSIs (pCLABSIs), which met the standard NSHN criteria for CLABSI and were not considered EOL CLABSI or dCLABSI. Definitions and examples are provided in Table 1. We performed χ^2 tests to compare categorical variables between the 3 types of CLABSIs. Data were stored and analyzed using Microsoft Excel software (Microsoft, Redmond, WA).

From 2019 to 2021, 147 CLABSIs occurred at our institution. Among them, 100 (68.0%) were classified as pCLABSIs; 20 cases (13.6%) were EOL-CLABSIs; and 27 cases (18.4%) were dCLABSIs. Overall, 66 CLABSIs (44.9%) occurred in an intensive care unit (ICU) setting, and there was no difference in the distribution of CLABSI types in an ICU versus non-ICU setting ($P = .130$). EOL-CLABSIs were significantly more likely to have had an underlying malignancy ($P = .016$), comprising 12 (60.0%) of the 20 cases, compared to 34 (34.0%) of 100 pCLABSI cases and 5 (18.5%) of 27 dCLABSI cases. Additionally, patients with EOL-CLABSIs were significantly older (median age, 68 years; interquartile range [IQR], 56–80) compared to pCLABSIs (median age, 54 years; IQR, 29–65), or dCLABSIs (median age, 53 years; IQR, 19–66).

We detected a microbiologic difference between pCLABSIs, EOL-CLABSIs, and dCLABSIs ($P < .001$) as well. Most pCLABSIs were due to gram-positive cocci (GPC, 63.0%), followed by *Candida* spp (24.0%) and gram-negative bacilli (GNR, 11.0%). Of the GPCs in pCLABSIs, 28.6% were due to *Staphylococcus aureus*. In comparison, GNRs were >3 times more prevalent in EOL-CLABSIs and dCLABSIs. GNRs were the most common organisms found in dCLABSIs (40.7%), and *Candida* spp (50.0%) were the most common in EOL-CLABSIs. Only 20.0% of EOL-CLABSIs and 22.2% of dCLABSIs were due to GPCs; none of these were from *Staphylococcus aureus*.

Using these proposed subgroups for defining CLABSIs, only ~66% of CLABSIs were preventable. The pCLABSI distinction is important. The inability of the CLABSI definition to discriminate causes and risk factors for bloodstream infections likely contributes to a "ceiling effect" in quality improvement. This false sense that a quality measure has been optimized may prevent further efforts toward improvement.[4] Furthermore, some patients with chronic central lines, such as those on total parenteral nutrition for short-bowel syndrome, may have unmodifiable risk factors for recurrent bloodstream infections that will repeatedly contribute to CLABSI rates, even with aggressive prevention strategies.[5] As central-line care optimizes over time, more difficult-to-prevent CLABSIs, such as those identified with the dCLABSI and EOL-CLABSI subgroups, will start to overshadow pCLABSIs, making it increasingly difficult to demonstrate the importance of infection prevention or observe statistical differences when studying novel prevention techniques.[6] Additionally, frontline clinical staff, such as bedside nurses, may feel significant pressure from leadership each time a CLABSI occurs, when a proportion of CLABSIs may not actually be preventable.

The EOL-CLABSI subgroup, in particular, highlights the number of CLABSIs that were diagnosed at the end of a patient's life,

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Table 1. Definitions and Clinical Examples

CLABSI Type	Definition	Clinical Example
Preventable (pCLABSI)	CLABSI meeting standard NSHN definitions.	Patient in the ICU for cardiogenic shock, who has a new fever without any other localizing symptoms and found to have an *S. aureus* bloodstream infection.
End-of-life (EOL-CLABSI)	CLABSIs that were determined clinically as caused by underlying disease processes in patients who were nearing the end of their lives due to a progressive comorbidity but who meet standard NSHN CLABSI definitions.	Patient in the ICU with advanced end-stage liver disease due to alcoholic cirrhosis with ongoing goals of care discussions, who develops ischemic bowel and grows *Enterococcus* from blood cultures.
Definition-based (dCLABSI)	CLABSIs that meet NHSN criteria but, based on the pathogen and the clinical situation, were caused by factors unrelated to end of life or the patient's central line.	Patient with advanced hematologic malignancy and neutropenic fever, with *Neisseria mucosa* bacteremia but who does not meet NHSN criteria for MBI or secondary CLABSI.

Note. CLABSI, central-line–associated bloodstream infection; ICU, intensive care unit; NHSN, National Healthcare Safety Network; MBI, mucosal barrier injury.

when management of any infection was likely futile for extending life. Unfortunately, central lines are commonly placed, and infections are frequently present in our most critically ill patients. Additionally, blood cultures are frequently sent as a part of a sepsis bundle as patients clinically decline. However, in our EOL-CLABSIs, these reflexive behaviors by our medical professionals likely diagnosed as a bloodstream infection that was nearly unpreventable due to a patient's underlying comorbidities and very likely would not change the outcome of the patient. We believe that specifically differentiating EOL-CLABSIs from dCLABSIs forces us to reflect on the number of patients who would benefit from early goals of care discussions instead of the reflexive medicine that we are taught to practice.

Our analysis had several limitations. The CLABSI assignments were subjective. However, categorizations between the 2 reviewers were 100% consistent. Having additional institutions apply similar subgroup classifications would be useful to determine the overall preventability of NHSN-defined CLABSIs. Nonetheless, these proposed definitions are meant to be a starting point that should be refined over time as more institutions attempt similar analyses.

In conclusion, although the majority of CLABSIs appear to be preventable, our analysis shows the presence of a large minority that are either related to patient's underlying disease process or are associated with the rigidity of standard NHSN definitions and are not preventable with standard infection prevention strategies.

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Patient-centered care to the detriment of the standardized infection ratio

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To the Editor—The Centers for Disease Control and Prevention (CDC) National Healthcare Safety Network (NHSN) uses an indirect standardization method for risk adjustment of surgical site infections (SSIs) by which procedures performed at a given