Impact of revising the National Nosocomial Infection Surveillance System definition for catheter-related bloodstream infection in ICU: Reproducibility of the National Healthcare Safety Network case definition in an Australian cohort of infection control professionals

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Background: Effective and comparable surveillance for central venous catheter-related bloodstream infections (CLABSIs) in the intensive care unit requires a reproducible case definition that can be readily applied by infection control professionals.
Methods: Using a questionnaire containing clinical cases, reproducibility of the National Nosocomial Infection Surveillance System (NNIS) surveillance definition for CLABSI was assessed in an Australian cohort of infection control professionals participating in the Victorian Hospital Acquired Infection Surveillance System (VICNISS). The same questionnaire was then used to evaluate the reproducibility of the National Healthcare Safety Network (NHSN) surveillance definition for CLABSI. Target hospitals were defined as large metropolitan (1A) or other large hospitals (non-1A), according to the Victorian Department of Human Services. Questionnaire responses of Centers for Disease Control and Prevention NHSN surveillance experts were used as gold standard comparator.
Results: Eighteen of 21 eligible VICNISS centers participated in the survey. Overall concordance with the gold standard was 57.1%, and agreement was highest for 1A hospitals (60.6%). The proportion of congruently classified cases varied according to NNIS criteria: criterion 1 (recognized pathogen), 52.8%; criterion 2a (skin contaminant in 2 or more blood cultures), 83.3%; criterion 2b (skin contaminant in 1 blood culture and appropriate antimicrobial therapy instituted), 58.3%; non-CLABSI cases, 51.4%. When survey questions regarding identification of cases of CLABSI criterion 2b were removed (consistent with the current NHSN definition), overall percentage concordance increased to 62.5% (72.2% for 1A centers).
Conclusion: Further educational interventions are required to improve the discrimination of primary and secondary causes of bloodstream infection in Victorian intensive care units. Although reproducibility of the CLABSI case definition is relatively poor, adoption of the revised NHSN definition for CLABSI is likely to improve the concordance of Victorian data with international centers.
Key Words: Laboratory-confirmed; catheter-related bloodstream infections; surveillance; intensive care unit; central venous catheter.

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Central venous catheter-related bloodstream infections are associated with mortality,[1] increased length of hospitalization,[1] and additional health care costs.[2,3] Standardized methods for surveillance have been adopted for benchmarking rates of infection and to enable assessment of the impact of targeted preventative measures on burden of illness.[4,5] Such methods rely on the use of a robust case definition, ensuring reproducibility of surveillance results.[6] Following implementation, evaluation of surveillance strategies should be performed, including assessment of the applicability of the chosen case definition.[7]

For intensive care unit (ICU) populations, standardized surveillance strategies for laboratory-confirmed,

central venous catheter-related bloodstream infections (CLABSI), including uniform case definitions, have been implemented in Victoria using the National Nosocomial Infection Surveillance System (NNIS) criteria.[5,8,9] These criteria require a trained infection control professional (ICP) to make an assessment of whether diagnostic microbiologic and/or clinical criteria are fulfilled for CLABSI. At the time of the study, NNIS criteria for CLABSI in patients >1 year of age were utilized by many international surveillance centers and included 3 criteria: criterion 1 (recognized pathogen isolated in blood culture), criterion 2a (skin contaminant isolated in 2 or more blood cultures drawn on separate occasions), and criterion 2b (skin contaminant isolated in 1 blood culture where the clinician institutes appropriate antimicrobial therapy).[9]

The objective of this study was to assess the reproducibility of the NNIS surveillance definition for CLABSI in a cohort of Australian ICPs. Furthermore, the effects of updating the case definition according to National Healthcare Safety Network (NHSN) recommendations[10] were retrospectively tested by modifying the existing case definition.

METHODS

Questionnaire

An 11-item questionnaire was generated to assess specific components of the NNIS diagnostic criteria by provision of a clinical case that was to be assessed according to whether it fulfilled criteria for CLABSI. Each question contained all relevant clinical and microbiologic information for complete assessment (Fig 1).

The 3 NNIS diagnostic criteria for CLABSI in patients >1 year of age were represented by 7 cases: criterion 1 (2 cases), criterion 2a (1 case), and criterion 2b (4 cases) (Table 1). Specifically, the individual 2b clinical cases contained information regarding the following: commencement of empiric antibiotics by the treating physician in the absence of results (preliminary or final) suggesting bacteremia, cessation of antibiotic therapy by the treating physician when the infecting organism is identified as coagulase-negative staphylococcus, and commencement of empiric antimicrobial therapy by the treating physician with antibiotic resistance reported for the infecting organism on the final antibiogram. Four cases were included that did not fulfill diagnostic criteria for CLABSI (secondary bloodstream infection in 3 cases, absence of clinical features of sepsis in 1 case) (Table 1).

To evaluate clarity and presentation, pretesting of the questionnaire by 2 ICPs who were not part of the intended target population was performed prior to study commencement (results not included in analysis). No change to content was required.

Study population

To enable sampling of a uniform population, all Victorian hospitals with ICUs participating in the Victorian Hospital Acquired Infection Surveillance System (VICNISS) were identified. ICPs responsible for ICU surveillance at these centers receive education regarding implementation of VICNISS methods and interpretation of surveillance definitions, including CLABSI surveillance methodology and reporting. Education is performed 6 monthly and has been provided since the inception of the program in 2002.

The VICNISS program includes large (>100 inpatient beds) and small center (<100 inpatient beds) surveillance modules. Additionally, a subset of all large Victorian hospitals is classified as large metropolitan centers (1A centers). These groupings are based on the size, number of separations, and function of each hospital and are stipulated by the Victorian Department of Human Services. They are also endorsed by the VICNISS Advisory Committee, comprised of key stakeholders in the program. The study was approved by the Institutional Ethics Review Committee affiliated with VICNISS.

The questionnaire was distributed to the ICP directly responsible for ICU surveillance at each hospital, the majority (18/21) being adult ICUs. As would be the practice for complex clinical cases, participants were instructed to inquire of other ICPs within their own department if uncertain about a particular question so that a single consensus opinion be obtained for each participating health care facility.

Participants were mailed a hard copy of the questionnaire. An electronic reminder was forwarded at 4 weeks and then at 6 weeks if no response had been made. Anonymity of respondents and associated health care facilities was maintained by removal of identifying data from completed questionnaires.

Statistical analysis

The questionnaire was also completed by CDC NHSN surveillance experts, and these responses were used as a gold standard comparator. The overall proportion of concordant responses was determined for each health care institution and for each question. To stratify according to hospital type, responses of 1A and non-1A centers were individually compared with results obtained from the external comparator. The κ statistic for 2 raters was used to determine agreement between individual centers and the external comparator, with 95% confidence intervals estimated by 1.96 $\times$ standard error. The κ statistic was also used to assess agreement among all participating centers (multiple raters).