Major Article

Assessment of the accuracy and consistency in the application of standardized surveillance definitions: A summary of the American Journal of Infection Control and National Healthcare Safety Network case studies, 2010-2016

Marc-Oliver Wright MT(ASCP), MS, CIC, FAPIC a,*, Katherine Allen-Bridson MScPH, BSN, RN, CIC b, Joan N. Hebden MS, RN, CIC c

a University of Wisconsin Hospitals and Clinics, Madison, WI
b Division of Healthcare Quality Promotion, National Healthcare Safety Network, Centers for Disease Control and Prevention, Atlanta, GA
c Infection Prevention Consultant, Baltimore, MD

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Background: The Centers for Disease Control and Prevention (CDC) National Healthcare Safety Network (NHSN) surveillance definitions are the most widely used criteria for health care-associated infection (HAI) surveillance. NHSN participants agree to conduct surveillance in accordance with the NHSN protocol and criteria. To assess the application of these standardized surveillance specifications and offer infection preventionists (IPs) opportunities for ongoing education, a series of case studies, with questions related to NHSN definitions and criteria were published.

Methods: Beginning in 2010, case studies with multiple-choice questions based on standard surveillance criteria and protocols were written and published in the American Journal of Infection Control with a link to an online survey. Participants anonymously submitted their responses before receiving the correct answers.

Results: The 22 case studies had 7,950 respondents who provided 27,790 responses to 75 questions during the first 6 years. Correct responses were selected 62.5% of the time (17,376 out of 27,290), but ranged widely (16%-87%). In a subset analysis, 93% of participants self-identified as IPs (3,387 out of 3,640), 4.5% were public health professionals (163 out of 3,640), and 2.5% were physicians (90 out of 3,640). IPs responded correctly (62%) more often than physicians (55%) (P = .006).

Conclusions: Among a cohort of voluntary participants, accurate application of surveillance criteria to case studies was suboptimal, highlighting the need for continuing education, competency development, and auditing.

Surveillance is “the ongoing, systematic collection, analysis, and interpretation of health data...integrated with the timely dissemination of these data to those who need to know.” Health care-associated infection (HAI) surveillance metrics used for public reporting and Centers for Medicare and Medicaid Services incentive-based programs as well as many surveillance programs worldwide, rely on the National Healthcare Safety Network (NHSN) Patient Safety Component Manual for surveillance definitions and criteria for re-portable HAIs. One characteristic of optimal surveillance definitions is that they are consistently applied by the individuals conducting the surveillance. In response to NHSN user feedback and changes in diagnostic tests and practices, the Centers for Disease Control and Prevention periodically revises the NHSN HAI surveillance definitions. In recent years, there have been reports of inconsistent application of the surveillance criteria amongst infection preventionists (IPs) as a result of state-level audits, among Veteran’s Affairs facilities, the Society for Healthcare Epidemiology of America Research Network, and when IP surveillance efforts are compared with the performance of a computer algorithm.

To provide an opportunity for education and to assess the application of NHSN criteria by IPs, a series of case studies was published in American Journal of Infection Control beginning in 2010...
and continuing today. Case studies included a link to a set of questions for anonymous use by readers seeking to test their knowledge of the NHSN definitions and criteria relevant to the case. Readers who submitted responses received the correct answers. This article aims to summarize the first 6 years of this project and describe the accuracy of volunteer participants in applying NHSN definitions to case studies developed by the authors.

METHODS

Based on questions submitted to the NHSN user-support mailbox by NHSN users and pertinent definitional changes in 2013 (eg, HAI and mucosal barrier injury) and 2015 (eg, infection window period and repeat infection time frame exclusion of fungal organisms in urinary tract infections) or new surveillance modules (eg, ventilator-associated events and laboratory-identified events), case studies with multiple-choice questions were developed by the authors. Each question and correct response required a detailed explanation and citations from the current NHSN manual for specific justification. Once the subject matter experts reached agreement with the draft of the case study, it was reviewed by staff members at NHSN for accuracy before being submitted and published in American Journal of Infection Control with a link to an online survey (SurveyMonkey Inc, San Mateo, CA). A June 2012 supplement offered continuing education credits and was hosted on the Centers for Disease Control and Prevention Training and Continuing Education Online Web site (http://www.cdc.gov/tceonline). Beginning with the ninth case study, published in October 2013, the introduction included a specific recommendation to use the appropriate NHSN manual section(s), with an external link to the particular section of the manual that would be needed for answering the questions.

Demographic characteristic questions asked of the participants pertaining to professional role (IP, physician director of infection prevention, or public health sector) and board certification in infection control as provided by the Certification Board of Infection Control and Epidemiology, were added to select case studies. Participants were advised that their responses to these questions were completely voluntary and did not impede their ability to complete the case study and receive the correct responses/explanations. Individuals anonymously volunteered to participate and submitted their responses through the online survey before receiving the correct answers and associated explanations. Participants who completed the case study were provided with the correct responses and explanations. Citations from the current Patient Safety Protocol were supplied for the rationale used in selecting the appropriate response. Surveys remained open for varying periods of time, but were closed in advance of any pertinent modifications to the NHSN modules to avoid any discordance between the rationale developed for the case study and the current NHSN specifications outlined in the manual.

The total number of participants per case study is the minimal number of persons who completed all questions. Whereas multiple responses from the same Internet protocol address were not accepted, incomplete submissions—in which the participant partially completed the case study—were accepted and included with the complete submissions in the analysis. Correct responses are presented as proportions with rate ratios, confidence intervals (CIs), and Pearson χ² P values for significance testing. Statistical analysis was performed using WinPEPI 8.1 (http://www.brixtonhealth.com/pepi4windows.html).

RESULTS

The cases studies, in chronological order with brief descriptions and proportion of correct responses by question and overall, are presented in Table 1.

There were 7,950 respondents who completed the 22 case studies published between June 2010 and July 2016. This includes 297 participants in each of the 9 case studies published as a supplement in June 2012 and ranged from 30 respondents to the ventilator-associated events case study in November 2013 to 811 respondents for the first case study in 2010. Of the 27,290 answers provided, 17,376 (62.5%) were correct. Correct responses by the participants varied widely between the case studies overall (48.0% for case #22 to 80.4% for case #2) as well as within the same case study between different questions (16.0%-87.0% for case #4). Of the 75 questions, the question with the lowest proportion of correct responses was the third question in case #4. The question presented the scenario in which a patient’s maximum temperature was 38°C, and the 705 respondents were asked if the patient, whose blood and urine cultures were positive for Providencia stuartii, had a urinary tract infection. Nearly 32% of respondents indicated that the patient had a symptomatic urinary tract infection despite the fever criteria included in the NHSN definition, which specifies that the temperature must be greater than, and not simply equal to, 38°C. Another 32% cited lack of symptoms for the patient not having any HAI, despite the organism being a recognized pathogen for bloodstream infection surveillance. Lastly, the remaining 20% of incorrect responses ascribed the condition to being an asymptomatic bacteriuric urinary tract infection despite the colony count of the urine culture being too low. The most successfully answered question came in case #2, where all but 9% of respondents recognized that the growth of an organism on a catheter tip culture was irrelevant in determining whether or not a patient had central line-associated bacteremia.

Participants were asked to self-identify as an IP, medical director of infection prevention, or employee in the public health sector for 12 of the case studies. These demographic characteristic questions were optional, but 82% (3,640 out of 4,466 participants) volunteered. IPs had the greatest participation rate at 93.0% (3,387 out of 3,640), followed by public health professionals (163 out of 3,640 [4.5%]) and physicians (90 out of 3,640 [2.5%]). Both IPs (7,375 out of 11,861 answers [62%]; rate ratio [RR], 1.14; 95% CI, 1.03-1.26) and public health professionals (346 out of 578 [60%]; RR, 1.09; 95% CI, 0.97-1.24) were more likely to respond to questions more accurately than program medical directors (168 out of 308 [55%]), although this finding was statistically significant for the IPs (P = .006) but not public health professionals (P = .13). IPs were no more likely to respond correctly to the case study questions than public health professionals (RR, 1.04; 95% CI, 0.97-1.11; P = .262). In the most recent case study, participants were asked to volunteer whether or not they were board certified in infection prevention and 83% (256 out of 308) responded. The majority of respondents (168 out of 256 [65.6%]) were board certified, yet this was not associated with an increased rate of correct responses to the questions (653 out of 1,344 vs 352 out of 704; RR, 0.97; 95% CI, 0.89-1.07; P = .54).

DISCUSSION

With more than 7,900 participants who provided nearly 28,000 answers over 6 years, the case study respondents are the largest cohort of individuals to be assessed regarding their ability to collectively apply the NHSN surveillance criteria to case studies. Most previously published similar reports of smaller cohorts have focused on interrater reliability; the extent to which 2 or more persons reviewing the same case agree with one another—regardless of whether they are both correct or not, emphasizing reliability and reproducibility over validity. Some studies have assessed whether participants answered the question(s) correctly, but it is less clear how the vignette itself was assessed for concordance with NHSN criteria. The use of vignettes and tests developed by active NHSN staff affords a high degree of confidence in the findings ob-
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