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Potential Misclassification of Urinary Tract-Related Bacteremia Upon Applying the 2015 NHSN Catheter-Associated Urinary Tract Infection Surveillance Definition

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Abstract

The Centers for Disease Control and Prevention recently updated the surveillance definition of catheter-associated urinary tract infection (CAUTI) to only include urine culture bacteria of 10^5 colony-forming units /mL. Our findings suggest that the new surveillance definition may fail to capture clinically meaningful CAUTI cases.

INTRODUCTION

As of January 2015, the Centers for Disease Control and Prevention (CDC) have updated the operational surveillance definition that hospitals are to use for identifying and reporting catheter-associated urinary tract infection (CAUTI) to the National Healthcare Safety Network (NHSN). Chief among these updates are: 1) an increase in the required bacterial culture to count 10^5 colony-forming units (CFU)/mL; and 2) no longer considering positive fungi in the urine as part of the CAUTI numerator.¹ Given the resulting increase in diagnostic specificity, we investigated the extent to which the new surveillance definition might fail to capture clinically meaningful CAUTI cases. As an example of cases that few would not argue are clinically meaningful, we assessed how often urine samples of a cohort of patients with urinary tract-related bloodstream infection would be identified as NHSN CAUTIs according to the updated surveillance definition.

METHODS

Setting

Patients were identified using retrospective medical record review at 3 Veteran Affairs (VA) Medical Centers (Ann Arbor, MI, Detroit, MI, and Indianapolis, IN) from 1 January 2000 to 31 December 2014. This study was approved by Institutional Review Boards at all 3 sites.

Data Collection

Patient data was extracted from the VA electronic medical record. All urine and blood cultures were ordered and collected at the clinical discretion of healthcare providers. Blood cultures were collected and incubated, and conventional microbiological methods were used for identification of microorganisms from blood and urine cultures.

Case Definition

Healthcare-associated urinary tract-related bloodstream infections in adult patients (≥ 18 years) were defined as: (a) positive urine and blood cultures with the same organism during hospital stay, (b) urine culture obtained at least 48 hours after admission, (c) urine culture growth of 10^3 CFU/mL,² and (d) blood culture obtained on the same day or after urine culture, but within 14 days of urine culture. Manual record review was conducted to identify and exclude cases that displayed evidence of primary bloodstream infections with hematogenous spread to the kidney.

Statistical Analysis

The urine CFU/mL values were grouped into 6 categories. The percentage of cases with CFU/mL counts less than 10^5 was calculated. We also examined the urine CFU/mL distribution in the subset of cases with positive bacterial cultures and documented presence of an indwelling urinary catheter prior to a positive urine culture.

RESULTS

Of the 287 patients that met the case definition, 41 were deemed to be “hematogenous seeding” cases after medical chart review, leaving 246 eligible cases for analysis. A total of 67% of the cases had their urine and blood culture samples collected on the same day, 8% had collection dates 1 day apart, and the remaining 25% had collection dates between 2 and 14 days apart. The distribution of positive urine culture microorganisms was as follows: coagulase-negative *Staphylococcus sp.* (23.6%), *Escherichia coli* (15.9%), *Candida sp.* (14.2%), *Enterococcus sp.* (11.4%), coagulase-positive *Staphylococcus sp.* (9.8%), *Pseudomonas sp.* (9.8%), *Klebsiella sp.* (7.3%), and other (8.1%). The urine CFU/mL distribution of the cases is illustrated in Table 1. A total of 82 (33.3%) cases had urine culture values less than 10^5 CFU/mL. Among the 211 cases with positive bacterial urine cultures (i.e., cases with *Candida sp.* excluded), a total of 68 (32.2%) cases had urine culture values less than 10^5 CFU/mL. Importantly, only 143 (58.1%) of all cases included in our study would be deemed positive upon applying the new NHSN definition.

A total of 145 (58.9%) of the cases had documented presence of an indwelling urinary catheter prior to the urine culture collection date. The urine CFU/mL distribution of this subset of cases is also illustrated in Table 1. A total of 40 (27.6%) of this subset of cases had urine culture values less than 10^5 CFU/mL. Among the 125 cases with both documented presence of an indwelling urinary catheter and positive bacterial urine cultures, a total of 32 (25.6%) cases had urine culture values less than 10^5 CFU/mL. Only 93 (64.1%) of all cases with documented catheter presence would be deemed CAUTIs upon applying the new NHSN definition.

DISCUSSION

Recognizing that laboratory variation in the reporting of urine cultures and urinalysis results may impact the number of CAUTI hospitals identify, the CDC has indicated that increasing the cut-point of bacterial urine culture counts to greater than 10^5 CFU/mL would “enable most laboratories to equally report all qualifying urine cultures” (thereby increasing the specificity and reliability of CAUTI reporting across US hospitals) and would “remove disincentives for urine culture collection in facilities using a threshold lower than this.”³ The CDC has also indicated that in most clinical scenarios, fungi pathogens were “clinically determined to be colonizers, not infecting organisms” and their inclusion in the surveillance definition may “over-inflate true CAUTI numbers.”³ While we acknowledge the rationale behind these decisions, findings from our study suggest that the increased specificity of the new CAUTI surveillance definition may fail to capture clinically meaningful CAUTI cases, as one-third of Veterans with urinary tract-related bloodstream infection had urine culture counts below the new cut-point, and nearly 15% had *Candida sp.* in the urine and blood. This is consistent with our prior work showing that an estimated 36% of women and 29% of men in a university hospital setting with urinary tract-related bloodstream infection had urine culture values less than 10^5 CFU/mL, and that *Candida sp.* accounted for nearly 17% of infections.⁴

Given the clinical and economic consequences of CAUTI and bloodstream infection,⁵⁻⁸ we have concerns regarding the implications of the potential disconnect between what the updated CAUTI surveillance definition will capture and real-world, clinical diagnoses and treatment patterns. First, although we acknowledge that clinicians do not solely rely on surveillance definitions when making treatment decisions, the new CDC surveillance definition has the potential to underestimate the burden of CAUTI-related illness. Second, and related, this has the potential to undermine the faith that clinicians have in the reliability of the national surveillance system for CAUTI. Specifically, standard of care would dictate that clinicians treat a patient for CAUTI (e.g., a catheterized patient with 10^4 CFU of growth of *E. coli*),² but the surveillance definition used would not consider this patient as having a CAUTI. Third, making longitudinal comparisons in CAUTI rates becomes difficult with definition changes, as it would require standardizing pre-definition change outcomes in accordance with the revised definition.

Our study has several limitations. First, the retrospective nature of our study affected our ability to determine whether or not the infection definitively originated from a urinary source. We addressed this by conducting manual chart reviews and excluding cases felt to have a clear competing bloodstream infectious source. Second, this was a regional, 3-site study of predominantly male veteran patients, and the generalizability of our findings may be limited. Further, we focused our study to patients with urinary tract-related bacteremia. As such, our findings only represent a fraction of all patients with bacteriuria or symptomatic CAUTI. Third, we were only able to confirm documented presence of a urinary catheter in approximately 60% of our sample. Although we cannot technically declare the infections lacking such documentation as CAUTI, it has been noted that the majority of healthcare-associated urinary tract infections stem from instrumentation of the urinary tract.¹ Additionally, our sensitivity analyses suggest that the new 10^5 CFU/mL cut-point would fail

to classify more than one-quarter of patients with bacteriuria and bacteremia with the same pathogen and documented presence of indwelling catheters.

Limitations notwithstanding, we have illustrated a potential disconnect between what the current CAUTI surveillance definition and clinicians would classify as a CAUTI. Our findings indicate that the current surveillance definition would fail to capture a substantial number of patients with clinically important CAUTI. This suggests that alternative modifications to the CAUTI definition, such as moving towards a clinician-based approach for diagnosis, should be considered. While such an approach will likely require medical record review and be more resource intensive, it will more accurately reflect the burden of CAUTI in the U.S. In the meantime, the current CDC definition will likely underestimate the burden of healthcare-associated urinary tract infection.

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REFERENCES

1. The Centers for Disease Control and Prevention. Urinary Tract Infection (Catheter-Associated Urinary Tract Infection [CAUTI] and Non-Catheter-Associated Urinary Tract Infection [UTI]) and Other Urinary System Infection [USI]) Events. 2015. <http://www.cdc.gov/nhsn/PDFs/pscManual/7pscCAUTICurrent.pdf>
2. Hooton TM, Bradley SF, Cardenas DD, et al. Diagnosis, prevention, and treatment of catheter-associated urinary tract infection in adults: 2009 International Clinical Practice Guidelines from the Infectious Diseases Society of America. *Clin Infect Dis*. 2010; 50:625–663. [PubMed: 20175247]
3. The Centers for Disease Control and Prevention. CAUTI: Definition Changes for 2015. 2015. <https://www.youtube.com/watch?v=M1FxO2WHTno>
4. Greene MT, Chang R, Kuhn L, et al. Predictors of hospital-acquired urinary tract-related bloodstream infection. *Infect Control Hosp Epidemiol*. 2012; 33:1001–1007. [PubMed: 22961019]
5. Saint S. Clinical and economic consequences of nosocomial catheter-related bacteriuria. *Am J Infect Control*. 2000; 28:68–75. [PubMed: 10679141]
6. Scott, R. The Direct Medical Costs of Healthcare-Associated Infections in U.S. Hospitals and the Benefits of Prevention. Division of Healthcare Quality Promotion National Center for Preparedness, Detection, and Control of Infectious Diseases Coordinating Center for Infectious Diseases Centers for Disease Control and Prevention. 2009.
7. Umscheid CA, Mitchell MD, Doshi JA, Agarwal R, Williams K, Brennan PJ. Estimating the proportion of healthcare-associated infections that are reasonably preventable and the related mortality and costs. *Infect Control Hosp Epidemiol*. 2011; 32:101–114. [PubMed: 21460463]
8. Zimlichman E, Henderson D, Tamir O, et al. Health care-associated infections: a meta-analysis of costs and financial impact on the US health care system. *JAMA Int Med*. 2013; 173:2039–2046.

Table 1

Distribution of Urine Culture CFU/mL

CFU/mL	All cases (N=246)		Cases with positive bacterial cultures (N=211)		Cases with documented indwelling urinary catheters (N=145)		Cases with documented indwelling urinary catheters and positive bacterial cultures (N=125)	
	Freq	%	Freq	%	Freq	%	Freq	%
1,000 & 10,000	4	1.6%	4	1.9%	1	0.7%	1	0.8%
> 10,000 & 25,000	30	12.2%	25	11.8%	13	9.0%	11	8.8%
> 25,000 & 50,000	21	8.5%	16	7.6%	9	6.2%	6	4.8%
> 50,000 & 75,000	17	6.9%	14	6.6%	12	8.3%	10	8.0%
> 75,000 & < 100,000	10	4.1%	9	4.3%	5	3.4%	4	3.2%
100,000	164	66.7%	143	67.8%	105	72.4%	93	74.4%

Abbreviations: CFU = colony forming units