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Received October 25, 16; accepted January 18, 2017; electronically published February 21, 2017
Infect Control Hosp Epidemiol 2017;38:619–621
 0899-823X/2017/3805-0020. DOI: 10.1017/ice.2017.19

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Impact of Changes to the National Healthcare Safety Network (NHSN) Definition on Catheter-Associated Urinary Tract Infection (CAUTI) Rates in Intensive Care Units at an Academic Medical Center

Catheter-associated urinary tract infections (CAUTIs) account for >30% of hospital-acquired infections (HAIs) reported by acute-care hospitals.[1,2] Acute-care hospitals are incentivized to reduce CAUTIs because it is one of the measures included in the Centers for Medicare and Medicaid (CMS) hospital-acquired condition reduction program.[3] The National Healthcare Safety Network (NHSN) provides standardized criteria for the surveillance definitions for CAUTI. There were major concerns with the previous 2013 NHSN CAUTI surveillance definition.[4] Effective January 2015, significant changes were made to the NHSN CAUTI definition: (1) the removal of urinalysis criteria, (2) an increase in the urine culture bacterial threshold from 10^3 to 10^5 colony-forming units (cfu), and (3) the exclusion of yeasts or molds as potential CAUTI pathogens.[5] The objective of our study was to determine the impact of the current 2015 NHSN CAUTI definition on publicly reported CAUTI rates in intensive care units (ICUs) at our academic medical center.

METHODS

We performed a retrospective analysis of the prospectively collected CAUTI surveillance data from January 1, 2013, to June 30, 2016. The setting included 7 ICUs at the University of Alabama at Birmingham Hospital, a 1,157-bed academic medical center. Trained infection preventionists perform CAUTI surveillance using the applicable NHSN definition and calculate the standardized infection ratio (SIR). To decrease the incidence of CAUTI, a CAUTI prevention bundle was implemented in late 2013, which included a nurse-driven urinary catheter removal protocol, an annual mandatory HAI prevention education module for all healthcare providers, and training of nursing staff in the proper techniques for urinary catheter insertion.

We examined the trend of our reported CAUTI rates from January 2013 to June 2016 in 7 ICUs and applied the current 2015 CAUTI definition to 2013 and 2014 CAUTI cases. Rates were compared using Pearson's χ^2 test; means were compared using 2-sample t test; and $P \le .05$ was considered statistically significant. Catheter utilization ratio (CUR, catheter days divided by patient days) was calculated to determine changes in the volume of catheter use. Data analyses were performed using Stata version 12.0 (StataCorp, College Station, TX).

RESULTS

When the corresponding NHSN definition for the respective year was applied, we observed a trend for decreasing yearly CAUTI rates. Even before the NHSN definition was updated, but during the implementation of the CAUTI prevention bundle, we observed a significant decrease in the CAUTI incidence rate (IR) from 5.7 UTIs per 1,000 catheter days in 2013 to 3.9 UTIs per 1,000 catheter days in 2014 ($P < .001$). During the 2-year period between January 2013 and December 2014, 345 CAUTIs occurred, but more than half of these did not meet the current (2015) NHSN definition. Notably, 44.1% of CAUTIs in 2013 and 50.3% in 2014 were due to yeast (Table 1).

With the current 2015 NHSN definition, we observed a significant decline in the CAUTI IR in 2015: 0.98 UTIs per 1,000 catheter days in 2015 versus 3.89 in 2014 ($P < .001$). When the current 2015 NHSN definition was applied to the 2013 CAUTI data, the CAUTI IR decreased by 57.5% from 5.7

TABLE 1. Catheter-Associated Urinary Tract Infection (CAUTI) Rates by Previous (2013) and Current (2015) National Healthcare Safety Network (NHSN) Definitions

Year	CAUTI IR by Previous NHSN Definition	CAUTI IR by Current 2015 NHSN Definition	Qualifying NHSN CAUTIs, No.	Yeast + UA Criteria, No. (%)[a]	Yeast CAUTIs, No. (%)	CUR
2013	5.66	2.40	206	119 (54)	91 (44.1)	0.82
2014	3.89	1.51	139	85 (61)	70 (50.3)	0.78
2015	N/A	0.98	38	N/A	N/A	0.74
2016[b]	N/A	0.87	17	N/A	N/A	0.72

NOTE. IR, incidence rates (ie, IRs reported per 1,000 catheter days); UA, urinalysis; CUR, catheter utilization ratio (ie, catheter days/patient days).
[a]UA criteria: positive urinalysis plus bacterial threshold between 10^3 and 10^5 colony-forming units.
[b]Up to June 30, 2016.

UTIs per 1,000 device days using the old definition to 2.4 UTIs per 1,000 device days with the current definition ($P = .001$). Similarly, the yearly CAUTI IR decreased from 3.89 UTIs per 1,000 device days with the old definition to 1.5 UTIs per 1,000 device days with the current definition ($P = .001$, relative risk reduction of 61.2%). Even using the current 2015 definition, we observed a trend for decreasing CAUTI rates from 2013 to 2016 unrelated to the definition change: (2.4 UTIs per 1,000 catheter days in 2013 to 0.87 in 2016 ($P < .001$). We concurrently noted a decreasing trend in CUR from 0.82 in 2013 to 0.72 in 2016 ($P = .09$), but more urine cultures were done in 2016 (50 cultures per month) than in 2013 (36 cultures per month).

DISCUSSION

We found that the current 2015 NHSN CAUTI definition resulted in a >50% decline in reportable CAUTIs, but this result coincided with the positive effect of our CAUTI prevention bundle. Our experience underscores the importance of using epidemiologic definitions that closely correlate with clinical definitions for CAUTI, especially in the era of public reporting. Clinicians may become less engaged in infection prevention efforts if they perceive that the cumulative CAUTI SIR is not at goal because of a faulty definition. Prior to 2015, the NHSN CAUTI definition was too broad to accurately detect the true incidence of CAUTI. When the previous CAUTI definition was introduced in 2013, certain changes did not allow for exclusion of fever from the criteria even if fever could be attributed to an alternative diagnosis. Neelakantha et al[6] reported that this minor change in the definition led to a >2-fold increase in NHSN-defined CAUTIs in their study. The current 2015 NHSN definition is more specific and correlates more closely with the clinical definition. Our findings also suggest that the overall decline in CAUTI rates was, in part, due to the CAUTI prevention bundle with a corresponding decrease in CUR. Despite implementing these interventions, the cumulative CAUTI SIR in the ICUs was still >1 until the NHSN definition was changed.

In conclusion, accurate surveillance definitions that coincide with clinical definitions are essential because CAUTI rates are now publicly reported and may affect a hospital's reimbursement rate. The definition change represents an opportunity to educate clinicians regarding these epidemiologically relevant definitions and appropriate use of antimicrobials.[7] Lastly, although the current cumulative CAUTI SIR is low, future interventions should target CUR and urine culture stewardship.[8]

ACKNOWLEDGMENTS

We thank the members of the UAB Infection Prevention team for their support of this study.

Financial support: No financial support was provided relevant to this article.

Potential conflicts of interest: All authors report no conflicts of interest relevant to this article.

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PREVIOUS PRESENTATION. The data from this study were presented in part at the 54th Annual Meeting of Infectious Diseases Society of America, IDWeek 2016, in New Orleans, Louisiana, on October 28, 2016 (abstract 945, session 131).

Received November 22, 2016; accepted January 24, 2017; electronically published March 10, 2017

Infect Control Hosp Epidemiol 2017;38:621–623
 0899-823X/2017/3805-0021. DOI: 10.1017/ice.2017.26

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Analysis of Bed Bug (*Cimex lectularius*) Introductions Into an Academic Medical Center

Bed bugs (*Cimex lectularius*) are an important human ectoparasite, but little is known about their impact on the healthcare system.[1–3] When a bed bug is captured at our institution a hired pest management professional (PMP) confirms and decontaminates the area where it was identified. The study objective was to investigate when and where bed bugs were found in the medical center and to determine the associated financial impact.

METHODS

Pest management costs for bed bug events were reviewed for a single tertiary-care academic medical center located in Cleveland, Ohio, between August 1, 2014, and August 31, 2015. The medical center had 973 inpatient adult, pediatric, and obstetrics and gynecology (OB/Gyn) beds; 80 of these were intensive care unit (ICU) beds. During the study period, the medical center had 30,478 adult medical/surgical admissions, 9,996 OB/Gyn admissions, and 10,761 pediatric admissions. The adult emergency department (ED) had 31 full-time (plus 16 part-time) beds and 67,525 patient visits. The adult ED discharged 43,580 patients and admitted 16,119 (24%). Of adult inpatients, 53% were admitted through the ED.

A generalized linear autoregressive moving average model (GLARMA) was applied to estimate the relationship between the number of bed bug events and various predictors while accounting for serial dependence over time. We assumed a 1-day lag model with a log link because the main outcome follows Poisson distribution.

RESULTS

During the study period, there were 180 bed bug events (or 1 event every 2.2 days); 72 of these events occurred in the adult ED; 40 of these events occurred on the adult inpatient floors; and 20 of these events occurred in the outpatient clinics or dialysis center (plus 5 instances in which it was unclear whether the bed bug originated from an inpatient or outpatient). Another 14 events occurred on the pediatric inpatient floor; 11 in OB/Gyn; 5 in the pediatric ED; 3 in the pediatric ICU; 2 in the adult medical ICU; 1 in radiology; and 7 in other parts of the hospital (ie, sickle cell center, preoperative area, endoscopy clinic, walk-in clinic, and laboratory). Moreover, 96 bed bug events (54%) occurred in the adult and pediatric inpatient and outpatient units; 77 bed bug events (42%) occurred in the adult and pediatric EDs, and 7 bed bug events (4%) occurred in other areas of the hospital. Furthermore, 138 bed bug events (77%) were associated with adult patients; 12% were associated with pediatric patients; 7% were associated with the OB/Gyn unit; and 4% were associated with other areas of the hospital. There was 1 bed bug event for every 938 patients in the ED, every 726 admitted adult inpatients, and every 633 admitted pediatric inpatients.

We investigated days of the week on which bed bug events occurred. In the medical center, 16 bed bug events occurred on Sundays, 23 on Mondays, 33 on Tuesdays, 34 on Wednesdays, 22 on Thursdays, 28 on Fridays, and 24 on Saturdays. In the adult ED, 7 bed bug events occurred on Sundays, 11 on Mondays, 14 on Tuesdays, 11 on Wednesdays, 6 on Thursdays, 12 on Fridays, and 11 on Saturdays. Using a GLARMA model with adult ED events as the outcome and adjusting for ED patient volume, no day of the week was statistically more likely to have bed bug events either in the hospital or the adult ED.

According to our GLARMA analysis, in the medical center, the mean number of bed bugs events in the months of November–April was 12.5 (standard deviation [SD], 3.45) compared with 15.3 (SD, 4.43) for May–October ($P=.45$). In the adult ED, the mean number of monthly bed bug events in November–April was 4.5 compared with 6.38 in May–October. In the adult ED, there were 23 bed bug events in the first 10 days of the month, 24 in the middle of the month, and 25 in the last 10 days of the month. A bed bug event was associated with 0.11% of adult ED patients, or 1 bed bug event every 5.5 days.

We did not find an association between bed bug events in the adult ED and the rest of the medical center using a GLARMA model with adult ED events as the outcome and adjusting for ED volume ($P=.98$). Furthermore, we found no association

https://doi.org/10.1017/ice.2017.26 Published online by Cambridge University Press