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Catheter-Associated Urinary Tract Infection: Does Changing the Definition Change Quality?

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Abstract

The CDC recently narrowed its definition of catheter-associated urinary tract infection (CAUTI) to exclude asymptomatic bacteriuria. While CAUTI rates declined after the definition changed, rates of related measures remained relatively stagnant, indicating that longitudinal measurements of CAUTI may be misleading and that the definition change itself did not impact care.

Introduction

Catheter-associated urinary tract infections (CAUTI) are common, can result in significant morbidity and cost, and recently have been targeted by several recent policies and programs to reduce their occurrence.^{1, 2} In January of 2009, the National Healthcare Safety Network (NHSN), the CDC's patients safety surveillance system, made a significant change to the definition of CAUTI: asymptomatic bacteriuria was removed, leaving only symptomatic and bacteremic cases of CAUTI to be counted.³ As a result, hospitals applying this new definition could have seen a sharp decline in the incidence of CAUTI beginning in January of 2009, making it difficult to assess the true impact of efforts to improve quality of care. In addition, the definition change itself could have been interpreted by hospitals as a signal to reduce the use of antibiotics to treat asymptomatic bacteriuria.^{4, 5} The objective of this study was to determine the impact of the CAUTI definition change on the reported rate of CAUTI and measures of care related to CAUTI, including rates of antibiotic treatment for positive urine cultures.

Methods

We conducted a time series analysis of secondary data. Data were extracted retrospectively from the electronic clinical information system for the medical and surgical inpatient units of a 760-bed academic hospital from July 1, 2007 through December 31, 2009. We excluded

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Conflicts of Interest

M.J.P. and J.P.M. have no conflicts to report.

operating rooms, pediatric, rehabilitation, labor/delivery, clinical research, and outpatient units, including the emergency department.

First, we measured the reported rate of CAUTI based on data collected by the infection control department. Before the definition change, if a urinary catheter was present, a positive culture collected more than 48 hours after admission was deemed a CAUTI (symptomatic or not). After the definition change, a positive culture was deemed a CAUTI only if the patient also was either symptomatic or bacteremic. The infection control department also collected a daily count of the number of urinary catheters in use in each unit of the hospital.

We next examined the change in rates of positive urine cultures and positive urine cultures treated with antibiotics, in contrast to the change in the rate of CAUTI, before versus after the CAUTI definition was changed. We chose these measures because they reflected aspects of care relevant to CAUTI but were not measured in the same way (and therefore were not directly affected by the definition change). Data for these outcomes were aggregated at the hospital unit level and summed to produce hospital-wide rates because urinary catheter utilization was not linked at the patient level to urine culture results or antibiotic utilization. A positive urine culture was defined as a culture with greater than 100,000 colony forming units of at least one bacterium. For each positive culture, we extracted medication order data to identify if any one of twelve antibiotics commonly used to treat UTIs was prescribed within 48 hours of collection of the culture specimen.

We ran separate multivariate Poisson regression models with each outcome measure. Covariates included a monthly time trend, time period (pre- vs. post-CAUTI definition change), month of the year (to adjust for seasonality), and the interaction between the time trend and time period. We estimated the magnitude of the effect of the definition change mid-way through the post-definition change time period and expressed the results as incidence rate ratios (IRRs). Catheter days per month were used as an offset in all of the models to account for changes in the volume of catheter use. Descriptive statistics were calculated per 1,000 catheter days and per 10,000 patient days, the latter of which assesses CAUTI outcomes independent of changes in catheter use.⁶ All analyses were performed using Stata version 11.0 (Stata Corp) and SAS version 9.1 (SAS Institute, Inc.).

Results

There was a mean of 7,139 catheter days per month (0.61 per patient day) for all included hospital units combined before the CAUTI definition change compared with 6,276 catheter days per month after (0.55 per patient day). The mean rate of urine cultures collected per 1,000 catheter days per month remained unchanged before versus after the definition change (Table 1). The mean rate of CAUTI per 1,000 catheter days per month declined significantly after the definition change, from 12.5 to 5.3 (incidence rate ratio [IRR] = 0.50, 95% confidence interval [CI] 0.41–0.60). In contrast, the mean rate of positive urine cultures per 1,000 catheter days per month did not change significantly (18.8 pre-definition change to 17.0 post-definition change; IRR = 0.94, 95% CI 0.81–1.08), nor did the mean rate of positive cultures treated with antibiotics (9.4 to 8.3; IRR = 0.84, 95% CI 0.67–1.01) (Figure 1). When examined by individual units within the hospital, results were similar.

Discussion

We found that monthly rates of CAUTI declined significantly after the definition of the measure changed. However, other measures that reflect aspects of care related to CAUTI but are not directly affected by the definition of CAUTI—monthly rates of positive urine cultures and positive urine cultures treated with antibiotics—remained relatively stagnant.

Catheter use declined during the study period, which is reflected in larger changes for all outcomes when calculated per 10,000 patient days (a population-based measure). However, the definition change itself was unlikely to have reduced catheter use, and the decline in CAUTI remains far more pronounced than the other measures.

Ours is the first study that reports the changes in CAUTI and CAUTI-related outcomes following the CAUTI definition change by the NHSN. The fact that CAUTI rates declined was expected, since the new definition excludes the previously included condition, asymptomatic bacteriuria. NHSN warns against historical comparisons of CAUTI rates because of the definition change.³ But infection control departments and other quality improvement groups still may monitor rates of CAUTI over time in order to assess efforts to reduce their occurrence. Such an approach would be misleading, and therefore longitudinal assessments of quality of care related to CAUTI that span the definition change should include alternative measures, such as the ones included in this study.

The absence of a significant decline in the rate of positive cultures treated with an antibiotic suggests that removal of asymptomatic bacteriuria from the CAUTI definition did not have the indirect benefit of signaling that use of antibiotics for that condition is usually inappropriate.^{7, 8} That is, the definition change itself does not appear to have affected clinical practice. This finding may not be surprising, since most clinicians are likely unaware of surveillance definitions. However, the definition change may have been a missed opportunity to teach clinicians about appropriate use of antibiotics, suggesting that further educational efforts are needed.

Our study has limitations. First, we were unable to describe patient-level outcomes because our data did not track urinary catheter use at the individual patient level. Second, an antibiotic could have been prescribed for reasons other than a presumed UTI, and therefore we may have overestimated the rate of this outcome. Third, while there was no hospital-wide effort to reduce catheter use or CAUTI during the study period, we were unable to assess whether individual unit initiatives were implemented or if they affected outcomes.

Our findings should serve to caution those monitoring quality of care related to CAUTI that surrogate measures will be needed to make recent longitudinal comparisons and efforts to educate practitioners regarding appropriate use of antibiotics for asymptomatic bacteriuria should continue.

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Figure 1.

Longitudinal plot of the studied outcomes during the 18 months before the CAUTI definition change (January 1, 2009) and the 12 months after.

Table 1

Outcomes before and after the CAUTI definition change

Outcomes per month *	Rate/1,000 catheter days (mean, SE)		Rate/10,000 patient days (mean, SE)		Incidence Rate Ratio (95% CI)
	Pre-change	Post-change	Pre-change	Post-change	
Urine cultures	105.0 (1.4)	105.0 (2.2)	645.2 (11.5)	578.1 (9.1)	0.98 (0.92–1.03)
Positive urine cultures	18.8 (0.6)	17.0 (0.6)	115.7 (4.0)	93.7 (3.5)	0.94 (0.81–1.08)
Antibiotic-treated positive urine cultures	9.4 (0.3)	8.3 (0.4)	57.6 (2.1)	45.8 (2.1)	0.84 (0.67–1.01)
CAUTI	12.5 (0.4)	5.3 (0.5)	77.3 (2.8)	29.2 (2.9)	0.50 (0.41–0.60)

* Cultures sent within 48 hours of admission excluded.