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Questionable validity of the catheter-associated urinary tract infection metric used for value-based purchasing

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Catheter-associated urinary tract infections (CAUTIs) occur in 290,000 US hospital patients annually, with an estimated cost of \$290 million. Two different measurement systems are being used to track the US health care system's performance in lowering the rate of CAUTIs. Since 2010, the Agency for Healthcare Research and Quality (AHRQ) metric has shown a 28.2% decrease in CAUTI, whereas the Centers for Disease Control and Prevention metric has shown a 3%-6% increase in CAUTI since 2009. Differences in data acquisition and the definition of the denominator may explain this discrepancy. The AHRQ metric analyzes chart-audited data and reflects both catheter use and care. The Centers for Disease Control and Prevention metric analyzes self-reported data and primarily reflects catheter care. Because analysis of the AHRQ metric showed a progressive change in performance over time and the scientific literature supports the importance of catheter use in the prevention of CAUTI, it is suggested that risk-adjusted catheter-use data be incorporated into metrics that are used for determining facility performance and for value-based purchasing initiatives.

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Catheter-associated urinary tract infections (CAUTIs) are 1 of the most common hospital acquired conditions (HACs) projected to occur in 290,000 US hospital patients annually, costing \$290 million.¹ Starting in October 2014 and continuing through September 2015, hospitals are being penalized 1% of their entire Medicare fee schedule if their performance is ranked in the lowest quartile for the prevention of HACs.²

The prevention of CAUTIs involves proper catheter insertion and maintenance along with using catheters only when indicated. The Association for Professionals in Infection Control and Epidemiology (APIC) along with others, have reported that the most important intervention in reducing CAUTIs is elimination or reduction in the duration of catheter use.³⁻⁵ APIC assigned the risk factor of prolonged catheter use (ie, >6 days) to the highest relative risk value (5.1-6.8).³

In addition, a facility's rate of CAUTIs is a nursing-sensitive outcome measure. High quality and adequate nurse staffing is required for both catheter maintenance and avoidance of catheter use.⁶ Centers for Disease Control and Prevention (CDC) guidelines

state that it is inappropriate to use urinary catheters "as a substitute for nursing care of the patient or resident with incontinence."⁷ Thus, avoidance of catheter use requires significant staff resources for ambulating patients to restrooms and changing wet bed linens. If staff resources are not allocated, then a wet environment may occur that may foster skin breakdown.

Facilities experiencing financial stress or those that are cost-driven may choose to cut staffing to augment a facility's income. Approximately 50%-70% of a hospital's operating budget is composed of staffing expenses, of which >50% is for nursing.⁶

Metrics used for hospital financial incentives are of the utmost importance. Almost one-third of the Centers for Medicare and Medicaid Services' HAC reduction penalty is based on the CDC CAUTI metric's analysis of data submitted to the CDC National Healthcare Safety Network (NHSN).² This is a significant penalty, estimated to total \$373 million and levied in an all-or-none fashion against 721 institutions.⁸

We evaluated 2 different CAUTI metrics, 1 from the CDC and the other from the Agency for Healthcare Research and Quality (AHRQ), to help determine which best represents a facility's performance.

METHODS

Two different metrics were evaluated. The first is the CDC metric for NHSN data (CDC NHSN CAUTI metric). These data are self-

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reported and converted into a standardized infection ratio (SIR) whose denominator is catheter-days divided by 1,000.⁹ The numerator is the number of infections. This ratio is then multiplied by a conversion factor that adjusts the data for various factors, including unit type (ie, medical or surgical) unit size, and being a major teaching facility.^{9,10} The baseline data were derived from 1,749 hospitals that reported data to the NHSN in 2009.⁹

There were 2 datasets available to evaluate the CDC NHSN CAUTI metric. The first was downloaded from [Data.Medicare.Gov](#). The second was obtained from CDC annual reports on hospital-acquired infections.^{11,12} The CDC annual reports contains a greater number of hospitals than the [Medicare.Gov](#) data for 3 reasons¹³: the CDC annual reports contain data from all reporting hospitals that report to the NHSN, whereas the [Data.Medicare.Gov](#) data are only from hospitals that participate in CMS Inpatient Quality Reporting program; the closeout date to report data for the specified acquisition dates in the CDC annual reports is a few months after the closeout date for the data in [CMS.Medicare.Gov](#); and the data in [CMS.Medicare.Gov](#) are only for intensive care unit locations, whereas the data in the CDC annual report include other locations.

The performance of the AHRQ CAUTI metric was derived from its analysis of approximately 18,000-33,000 randomly selected medical records per year,¹ from patients with the subset of diagnoses for myocardial infarction, heart failure, pneumonia, and major surgical patients,^{14,15} from 800 randomly selected hospitals in the Centers for Medicare and Medicaid Services Inpatient Quality Reporting program.¹⁶ Records were reviewed using a structured protocol¹ and software tool (ie, Medicare Patient Safety Monitoring System).^{1,14-17} This dataset is chart-reviewed data whose denominator is hospital discharges divided by 1,000 and whose numerator is CAUTI Infections. The method of AHRQ sampling changed little between the years 2010 and 2013 and the use of a consistent data source and techniques helped to ensure that the data are unbiased.¹

Because the datasets for the 2 metrics in question are derived from different government agencies and programs, their baseline data acquisition dates differed by 1 year.

RESULTS

CDC NHSN CAUTI metric

The SIR derived from the NHSN average hospital performance data downloaded from [Data.Medicare.Gov](#) showed a 3% increase in CAUTIs for the year 2013 (SIR, 1.03) compared to the 2009 baseline⁹ (see [Table 1](#)). These data reflect the average for hospital performance. The annual CDC CAUTI progress reports found a 3% increase in the 2012 SIR and a 6% increase in the 2013 SIR, compared with the 2009 baseline.^{11,12}

AHRQ CAUTI metric

AHRQ reported a 28.2% progressive decrease in CAUTIs between the years 2010 and 2013^{14,16} (see [Table 1](#)). If one assumes the lower figure of reviewed medical records ($n = 18,000$) for the sample size and multiply this by the reported rate, the progressive improvement in CAUTIs between the years 2010 and 2013 (reviewed records with CAUTI / reviewed records without CAUTI) has a statistical significance of $P < .011$ (X^2 , 221/17,779; 203/17,797; 190/17,810; and 158/17,842).

DISCUSSION

Currently, the Centers for Medicare and Medicaid Services uses the CDC NHSN CAUTI metric for its value-purchasing initiatives. However, the validity of this initiative needs to be examined because the AHRQ and the CDC NHSN CAUTI metric give widely varying

Table 1

Comparison of the National Healthcare Safety Network (NHSN) and Agency for Healthcare Research and Quality (AHRQ) metrics for catheter-associated urinary tract infections

Metric	Data and date of acquisition				
	2009	2010	2011	2012	2013
Centers for Disease Control and Prevention NHSN (Data.Medicare.Gov)					
Standardized infection ratio ⁹	1.00			0.99	1.03
Number of facilities	~1,749			2,293	2,277
Centers for Disease Control and Prevention NHSN (HAI progress reports)					
Standardized infection ratio ^{9,11,12}	1.00			1.03	1.06
Number of facilities	~1,749			3,597	2,781
AHRQ ^{1,14,16}					
Infections/1,000 discharges		12.25	11.30	10.58	8.8*
Baseline ratio		1.00	0.92	0.86	0.72*
Number of charts ¹		~18,000-33,000 medical records from 800 hospitals			

*Preliminary Data.

results. We believe that this difference results from variations in definitions and possibly in the method of data collection. The AHRQ data were derived from medical record audits and the AHRQ metric uses a denominator of hospital discharges.¹ The CDC data are self-reported and the denominator is catheter-days.⁹ Which accurately portrays our health care system's performance?

The CDC Healthcare Infections Control Practices Advisory Committee reported that CAUTI metrics may include the number of CAUTIs per 1,000 catheter-days and the catheter use ratio (ie, [urinary catheter-days / patient-days] \times 100).⁷ However, because the CDC NHSN CAUTI metric uses a denominator of catheter-days, efforts to minimize catheter use are negated. In addition, a financial incentive program advisor to the CDC the National Quality Forum also uses a metric with a denominator of catheter-days.¹⁸ Because the AHRQ metric uses a denominator of hospital discharges, it measures both catheter use and catheter care.

A report by Horstman et al¹⁹ suggested that using metrics with either device-days or catheter-days were equally effective in comparing health care-associated infections between facilities. However, this report compared the performance for the entire group of facilities over time and device use was not substantially different between comparison groups. Thus, it could be argued that the experimental design was not the best for evaluation of a metric intended to measure device use.

Metrics that do not account for catheter use may place hospitals that curtail their catheter use at a disadvantage. One can also make the argument that if lower catheter use lowers infection rates, then the catheters that are used are probably used on sicker patients. These facilities may have a higher SIR as measured by the CDC NHSN CAUTI metric.²⁰ Additionally, they may also receive a financial penalty while at the same time they are increasing their nursing staffing and providing better care.

The AHRQ metric is a nursing-sensitive metric that promotes and encourages high quality and adequate nurse staffing. Thus, financial incentives based on this metric would be expected to have a far-reaching effect on many different quality parameters throughout the institution. It can also be argued that the CDC NHSN metric favors facilities that may be subsidizing their operating budget by providing patient care with low nurse staffing levels, and provide a mechanism to circumvent the intent of value-based purchasing initiatives that are intended to promote the provision of quality health care.

Both catheter use and catheter care measurements are important. The quantitated risk factors published by APIC³ indicate that the catheter use component of a metric should be more heavily weighted. Currently, not having a catheter use component in the CDC metric appears to hinder its ability to differentiate between good and poor performance. The AHRQ metric combines these

components (ie, use and care) and by demonstrating a progressive significant improvement, appears to differentiate good versus poor performance on a systemwide level.

Concerns regarding the reliability of self-reported data has been an issue with patient advocates and was heightened by the March 2010 US Department of Health and Human Services Office of Inspector General report (OEI-06-08-00,221),²¹ which found that audited hospitals did not have incident reports for 93% of adverse events. The CDC reports that only 20 of the 50 states check CDC NHSN CAUTI data for quality and completeness.¹¹ To have the most accurate value-based purchasing initiatives, the health care industry should be supportive of expanded data verification.

LIMITATIONS

Although the AHRQ metric appears to be valid in describing performance on a systemwide level, it is not risk-adjusted, and therefore may not have the same validity with comparisons between facilities. This study is not intended to suggest a final metric for CAUTI measurement, but to act as an impetus for the development of a risk-adjusted AHRQ metric.

The AHRQ and the CDC NHSN datasets were collected differently. The AHRQ data were not derived from claims data but from a structured medical record review. The CDC NHSN data were collected by hospital employees with an infectious disease background and not independently verified. There are concerns regarding the integrity of nonindependently verified facility data that are collected by personnel having a conflict of interest with the facility.

The datasets used to compare the 2 metrics were derived from very large but different patient populations. Although there is significant overlap in these populations, the derived rates for any 1 year are not comparable between the two data sets without the implementation of a conversion factor as described by AHRQ.¹ However, our study analyzes the change in the incidence of CAUTIs across time and for such large and overlapping patient populations this change should be comparable between the 2 datasets. At the very least, the observed different results given by the 2 metrics, along with the data from APIC and other authors,³⁻⁵ dictate a reevaluation of the use of the current CDC NHSN metric in value-based purchasing initiatives.

CONCLUSIONS

Regardless of which factors are responsible for the widely varying results in these 2 government CAUTI metrics, the fact that the results are so different raises questions regarding the accuracy of the rates for CAUTIs that are currently used in value-based purchasing initiatives. In its present form, we question whether the CDC NHSN CAUTI metric can adequately differentiate between well-performing and poorly performing facilities. The Centers for Medicare and Medicaid Services may need to redefine the metric used for the CAUTI portion of their HAC reduction program by using a denominator for risk-adjusted hospital discharges or by incorporating a risk-adjusted catheter use ratio. In addition, data verification should be considered a high priority when financial incentives are being levied.

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