Accuracy of a urinary catheter surveillance protocol

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Background: Many hospitals are increasing surveillance for catheter-associated urinary tract infections, which requires documentation of urinary catheter device-days. However, device-days are usually obtained by chart review or nursing reports. The aim of this study was to demonstrate that chart review can provide accurate urinary catheter data compared with physical inspection of the urinary catheter at the bedside.

Methods: We compared 2 methods for collecting urinary catheter data over a 6-month period on 10 wards at our VA hospital. For the chart reviews, we created a daily bed-occupancy roster from the electronic medical record. Catheter data were extracted from the daily progress notes for each patient using a standardized review process. Bedside reviews were conducted by visiting the ward and verifying the presence and type of urinary catheters. Agreement between the 2 methods was calculated.

Results: We obtained urinary catheter data by both methods in 621 cases. The presence or type of urinary catheter differed between chart and bedside review in only 10 cases (1.6%). Chart review had a sensitivity of 100%, a specificity of 97.7%, raw agreement of 98.4%, and a $\kappa$ value of 0.96.

Conclusions: Individual chart review in the electronic medical record provided very accurate data on urinary catheter use.

Key Words: Catheter-associated urinary tract infection; infection control; chart review; infection; infection control.

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There is increased interest in the elimination of health care–associated infections, including catheter-associated urinary tract infection (CAUTI). Societal changes, such as Center for Medicaid and Medicare

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Services (CMS) nonreimbursement for CAUTI and increased public reporting of health care–associated infections, contribute to this interest. Many hospitals are adopting “bladder bundles” aimed at reducing rates of CAUTI through the optimal use of urinary catheters.1 This increased attention has resulted in a proliferation of guidelines and recommendations addressing CAUTI prevention.2-5

Surveillance for urinary catheter use (reported in device-days) is a cornerstone of any effective program to reduce CAUTI. Effective surveillance for urinary catheter use is essential to accurate documentation of CAUTI rates. Moreover, accurate surveillance for urinary catheter use is necessary to monitor whether interventions to decrease inappropriate catheter use are effective. Nonetheless, a survey of 719 United States hospitals published in 2007 reported that 56% of the hospitals surveyed did not have a system for monitoring which patients had a urinary catheter placed, and 74% of hospitals did not monitor duration of catheterization.6 Urinary catheter surveillance is undoubtedly complicated by the fact that even the patient’s physician is often not aware that a urinary catheter is in place.7

The Veterans Health Administration (VHA) provides comprehensive health care for an estimated 5.5 million veterans each year through 153 medical centers in the United States. In 1998, the VHA adopted an electronic medical records system, the Computerized Patient Record System (CPRS), which has become the sole charting and documentation system used in all of its
health care facilities, both inpatient and outpatient. Of note, urinary catheter insertion and monitoring are not officially documented in the CPRS unless the urinary catheter is placed as one of a set of “quick orders” often used at admission. Quick orders convert each order into an “orderable item” that later can be pulled from the medical record electronically. However, urinary catheters are usually inserted via a text order or without an order, and electronic queries cannot be used for free text. Furthermore, the only way to order urinary catheter removal is to write a free text order; thus, catheter removal likewise is not captured in a format that can be searched electronically. “Data objects,” such as vital signs and medications, can be counted through electronic chart review, but the CPRS contains no data item concerning urinary catheters. Thus, although nurses often record the presence of urinary drainage devices in their daily notes, this information cannot be pulled electronically from VHA charts without individual chart review.

We recently launched an intervention to increase adherence to guidelines concerning nontreatment of catheter-associated asymptomatic bacteriuria. The first year of this ongoing project involves surveillance for urinary catheter use and associated bacteriuria in 10 hospital wards at the Michael E. DeBakey Veterans Affairs Medical Center (MEDVAMC). Numerous previous studies have documented the extremely low sensitivity and positive predictive value of using ICD-9-CM codes to identify hospital-acquired infections, including CAUTI. Others have looked at developing automated surveillance methods for catheter device-days. In all of these studies, the gold standard for establishing the presence of a urinary catheter was chart review, either by a physician trained in urinary tract infection (UTI) criteria or by an infection control practitioner. Furthermore, although we found several studies documenting the point prevalence of urinary catheter use in various settings, such as VA nursing community living centers and nursing homes, we did not find any studies demonstrating that chart review or nursing report accurately reflected whether a patient has a urinary catheter. Because the accurate documentation of urinary catheter device-days is essential to our project, we wanted to verify the accuracy of chart review against bedside examination for the presence and type of urinary catheters. Because asymptomatic bacteriuria arises from all urinary catheter types, not just from indwelling urethral catheters, we have been monitoring the device-days for indwelling, external (condom), suprapubic, and intermittent urinary catheters. Our hypothesis was that a detailed, patient-level chart review in the CPRS would provide accurate catheter data compared with bedside surveillance. We also describe our surveillance methods for urinary catheter use and for catheter-associated bacteriuria, which can be adopted by other health care personnel interested in prevention of CAUTI.

METHODS

Setting

This study was conducted in 10 hospital wards in the Houston, Texas MEDVAMC. These wards include five acute general medicine wards and five extended care units. Of the five extended care units, four provide inpatient nursing home care, and one is a transitional care unit housing patients who are recovering as inpatients from an acute illness or procedure. The study design was approved by Baylor College of Medicine’s Institutional Review Board and MEDVAMC’s Research and Development Committee.

Catheter surveillance via chart review

On 5 days each week, we performed a standardized electronic chart review in the CPRS. We first logged each patient present on the 10 surveyed wards on that day in our Microsoft Office Excel 2007 screening roster. The daily chart review was necessary because the CPRS maintains a list of patients on each ward in real time only. Once a patient has been discharged, the patient is removed from the list of patients on that ward, and so the CPRS cannot be used to determine the names of patients who were on a given ward in the past. The weekend patient rosters were extrapolated from the preceding Friday and following Monday. The daily roster of patients provided the patient bed-days for the denominator of our catheter surveillance. The screening roster was password protected and stored behind the VHA firewall.

To find urinary catheter data, each patient’s chart was opened and the daily progress notes were reviewed systematically for documentation of the presence of a urinary catheter or, alternatively, for documentation that the patient was able to use the bathroom to void. Catheter information was more often found in the nurse’s notes than in the physician’s notes. Catheter data were gathered by reviewing several different types of chart notes for each patient-day. The note types reviewed included nursing reassessments, nursing activities of daily living, nursing emergency room assessments, and nursing admission screening assessments. Physician notes were also reviewed when available. (Inpatients on the extended care wards do not have daily physician notes.) Research personnel searched these notes for references to catheters, comments on urinary output, and whether the patient had bathroom privileges (and thus was not catheterized). If a urinary
catheter was reported in the chart, then the type of urinary catheter was recorded in our roster, in one of the following categories: indwelling Foley (transurethral) catheters, external (condom) catheters, suprapubic catheters, and intermittent catheterization programs.

**Catheter surveillance through bedside visits**

Bedside visits were conducted by research personnel, who visited each patient on a given ward to determine whether the patient had a catheter and, if so, the type of catheter present. On a bedside visit, catheter type was determined by physical inspection of the patient; however, if the patient was fully dressed, in a public space, or had bedside visitors, we relied on the presence of a catheter drainage bag or a used urinal to signify the presence or absence of a urinary catheter without further confirming the type of catheter. In the beginning of the study, bedside checks were completed 3 times per week on each ward. After the first 4 months of dual surveillance (chart review and bedside visit), bedside visits were scaled back to 1 ward on 1 day per month.

**Monthly surveillance summaries**

Ward rosters were combined by Excel into a summary roster using Excel (Microsoft, Redmond, WA). The 11th page (tab) of our monthly Excel roster pulled data from each of the 10 wards surveyed into its monthly summary of bed-days, overall urinary catheter device-days, device-days for specific types of urinary catheters, total number of urine cultures sent, total positive urine cultures, total number of urine cultures sent from catheterized/noncatheterized patients, total positive urine cultures from catheterized patients, and total number of positive urine cultures collected from various catheter types. These summary values were then standardized by 1,000 bed-days and by 1,000 catheter-days.

**Measures of agreement**

Our measures of agreement between the 2 methods of identifying urinary catheter use included the overall raw agreement, sensitivity, specificity, positive predictive value, negative predictive value, and $\kappa$ statistic. In this study, determination of catheter use by the bedside visit was considered our criterion or gold standard. Overall simple agreement is the number of cases in which both the bedside visit and the chart review indicated that the patient had a catheter plus the number of cases in which both methods indicated the patient did not have a catheter, out of all cases studied. Sensitivity assesses the probability that the chart review indicated that a catheter was present, given that the patient did not have a catheter at the bedside visit. The positive predictive value is the probability that bedside visit indicated that the patient had a catheter, given that the chart review found a catheter. The negative predictive value is the probability that the bedside visit did not find a catheter, given that the chart review indicated that a catheter was not in place. The 95% confidence intervals were calculated with the VassarStats Website for Statistical Computing, which uses the efficient-score method of Newcombe.

We also calculated the $\kappa$ statistic, which takes into account the agreement occurring by chance, although this is generally used as a measure of the agreement between 2 methods when neither is considered a gold standard. SAS version 9.2 (SAS Institute, Cary, NC) was used for these calculations.

**RESULTS**

**Bedside to chart review**

We obtained urinary catheter data by both electronic chart review and bedside visit for 621 patient-days (Table 1). Of the 197 catheter-days identified by chart review, 10 catheters (5.1%) were not present on bedside visit. Based on chart review, in 5 of these cases we expected to find an indwelling urethral catheter, and in 5 cases we expected to find an external (condom) catheter. These discrepancies occurred in 10 distinct patients. In 5 of the 10 cases of disagreement between chart review and bedside visit, a re-review of the chart later in the day suggested that the catheter had been removed on the day of the bedside visit, before the visit. However, in the other 5 cases of disagreement, the chart continued to indicate that a catheter was present in the days after the bedside visit, reflecting a true error in chart documentation.

Overall raw agreement was 98.4% (95% confidence interval [CI], 96.7%-99.2%), indicating that in 611 of 621 cases, the bedside visit and chart review yielded the same result. The chart review had a sensitivity of 100% (95% CI, 97.5%-100.0%) and a specificity of 97.7% (95% CI, 95.7%-98.8%). The $\kappa$ coefficient was 0.96 (95% CI, 0.94-0.99). Using bedside visit as the gold standard, chart review for urinary catheters had a 95% positive predictive value (95% CI, 90.6%-97.4%) and a 100% negative predictive value (95% CI, 98.9%-100.0%).

**Application of the surveillance method in practice**

Bedside review face some practical challenges. The main issue was that some patients were out of their rooms or being seen by a physician at the time of the visit. Bedside visits required 30-90 minutes per
DISCUSSION

Patient-level review of electronic medical records in the VHA CPRS system reflects the presence and type of urinary catheters with a high degree of certainty. An effective chart review approach requires appropriate training, a standardized process, and personnel dedicated to the project. However, chart review is more efficient than bedside visits and is an equally accurate means for capturing urinary catheter data.

Many investigators have commented on the limitations of using administrative (electronic) coding data to capture urinary catheter device-days. For example, Meddings et al. reviewed 80 randomly selected adult discharges from the University of Michigan Health System with secondary-diagnosis UTIs. Although the physician abstractor identified 37 (46%) of these cases as CAUTI, hospital coders did not identify any of these cases of CAUTI. Apparently the coders had not applied the catheter-association code to any of these cases. The authors believed this that error occurred because coders sought diagnosis information from provider notes, but catheter use was documented only in the nursing notes in their hospital. Likewise, Zhan et al. found that the ICD-9-CM procedure codes for urinary catheterization appeared in only 1.4% of Medicare claims for patients who actually had urinary catheters according to medical records abstraction. Insertion of urinary catheters without a specific physician order likely is a contributing factor to the inability to identify catheter device-days using administrative data. For example, Fakih et al. recently noted that only 47% of urine catheters placed in the emergency department of a large tertiary care hospital had a documented physician order. The issue identified in all these studies, as in our study, is that urinary catheters are generally placed without a physician order and are maintained without specific documentation in the medical record.

Two options exist for accurate recording of urinary catheter device-days: conducting individual medical records review or modifying the electronic medical record to contain fields for urinary catheter information. Individual medical record review, as we have done, is both very accurate and very time-consuming. On the other hand, Wright et al. reported on successful automation of device-days, including urinary catheters, by introducing a “dropdown spreadsheet of institutionally defined categories” in which nursing staff document the condition of all invasive devices several times per shift. In the 3 private hospitals studied by Wright et al. review of a random selection of medical records by an infection control practitioner served as the gold standard, and the automated system was 99% sensitive and 99% specific for urinary catheters. The VHA electronic medical record would require significant modification to make documentation of urinary catheters standardized and mandatory to allow automatic capture of device-days.

Our study was performed in a single VA center with a fully integrated electronic medical record, which might limit the generalizability of our results. However, an increasing number of hospitals are switching to a fully integrated medical record. Given that we did not find any

Table 1. Comparison of chart review and bedside visit for the presence or absence of catheters

<table>
<thead>
<tr>
<th>Chart review</th>
<th>Bedside visit</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Patient had a catheter</td>
<td>Patient did not have a catheter</td>
<td>Total</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Catheter reported in chart</td>
<td>187</td>
<td>10</td>
<td>197</td>
<td></td>
</tr>
<tr>
<td>Catheter not reported in chart</td>
<td>0</td>
<td>424</td>
<td>424</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>187</td>
<td>434</td>
<td>621</td>
<td></td>
</tr>
</tbody>
</table>

NOTE. If a patient was listed a ward on review of the electronic ward roster, we logged 1 patient-day. If the patient was found to have a catheter, by either chart review or by bedside visit, we recorded 1 catheter-day. Patients were counted as having multiple patient-days if they remained on the ward for more than 1 day. This table records the correspondence between catheter-days found by chart review to catheter-days found by bedside visit.

ward plus approximately 30 minutes of travel time to and from the ward, depending on the number of beds occupied on a ward, the number of patients on contact precautions, and the ward’s location. The complete catheter documentation required repeated visits to the same ward during the course of each day. In contrast, reviewing all of the patient charts on a given ward required only 15-60 minutes, depending on the number of patients newly admitted to the ward and the number of urine cultures sent. Chart review can be done from any VHA computer terminal, thereby eliminating the significant travel time at our large facility. Our urinary catheter surveillance (chart-based plus bedside spot checks) is performed by a full-time research assistant, who spends approximately 30 hours per week on surveillance alone. Data accuracy for the ward summary sheets is assessed by a research coordinator (one who did not prepare the sheet under review) who performs spot checks on individual patients at the end of each month. The research coordinator also performs a monthly higher-level check of the formulas in the summary sheet by making sure all results sum to expected totals; for example, the number of catheter-days should be the sum of the indwelling, condom, intermittent, and suprapubic catheter-days. A team meeting of the research assistant, the research coordinator, and the principal investigator is held monthly to review the completed data summaries for the previous month.
unexpected catheters on bedside visits, it is possible that our belief, based on chart review, that the patient was not catheterized led to a less-thorough search for a catheter while at the bedside. But whether a urinary catheter is present or not is a fairly concrete observation, and thus we do not believe that bias played a significant role in decreasing our detection of urinary catheters. Our surveillance roster may potentially miss a few urinary catheters used by patients admitted and discharged within a single weekend; however, patients with such short stays are typically ambulatory and living independently, and thus are less likely to require urinary catheters while hospitalized.

Because CMS reimbursement for CAUTI is linked to determining whether the infection was acquired within the hospital, every hospital needs an accurate method for documenting urinary catheter use and related infections. Furthermore, the VHA is adopting a nationwide policy, to be fully implemented by 2013, to reduce the unnecessary use of urinary catheters in an effort to reduce the incidence of CAUTI. A major component of this initiative is the institution of hospital-wide monitoring of urinary catheter use, which may provide an opportunity to improve CPRS documentation of urinary catheters. Although the real gold standard for catheter surveillance is bedside review, here we present an alternative method that is more efficient and equally accurate. However, we question whether institutions without dedicated personnel will be able to provide this level of detailed surveillance to accurately identify the presence of urinary catheters for such reporting. Currently, urinary catheters in the VHA system not only are under the bed sheets, but also under the radar of any electronic surveillance.

CONCLUSION

We have established a system for highly accurate, detailed surveillance of urinary catheter use and catheter-associated urine cultures. Patient-level review of nursing notes in the electronic medical record is a reliable means for assessing urinary catheter types and device-days used in our institution. To accurately report the CAUTI rates in our hospitals to the American public, we must first provide accurate data on urinary catheter device-days for the denominator.

References