APR-DRG weights were available for 1,303 patients (80%). The mean APR-DRG weights were 2.3 for those who never had a VC, 3.6 for those who average 0–1 VC, and 6.9 for those who averaged more than 1 VC. Pairwise comparisons of APR-DRG means were significant, with P values of .001, <.0001, and <.0001, respectively (Figure 1).

We undertook an observational pilot study to better understand the intensity of VC use in our ICUs. Our findings demonstrate that device utilization, as defined by the NHSN, underestimates the actual number of VCs employed. By counting the actual number of catheters, our DUR doubled. Our work also demonstrated an association between increased intensity of VC use and measures of SOI.

All of the 18 CLABSIs identified during the study period occurred in patients who averaged more than 1 VC. The risk of BSI with different types of VCs, including arterial lines, has been reported previously.[2,3] However, the incremental risk as more devices are required is unknown. Although Tejedor et al[4] recently demonstrated that a large percentage of CVC-days in a non-ICU population were potentially unnecessary, our study suggests that, in the ICU, more line-days are associated with increased SOI and not with increased opportunity for line removal. Our findings also indicate that not all ICU patients are at similar risk for CLABSI and support total VC-days as a denominator for defining a population for CLABSI rate calculation. Tokars et al[5] have demonstrated that central-line-days, as opposed to patient-days, was an appropriate risk adjustment for comparing interfacility rates, because percentile error increased as ICU DUR decreased. Our findings suggest that, for ICUs caring for patients with a high SOI, total VC-days should similarly be considered as an appropriate risk adjustment, because a hospital's CLABSI rate is increasingly used to publicly compare the quality of care provided.

The limitations to our study include that observations were performed 5 days per week, that APR-DRG and APACHE IV scores were not available for the entire cohort and are not stratified by unit type, and that no adjustment was made for confounders of the relationship between VC use and severity of illness. Finally, although a substantial number of patients were observed, this was a pilot study that merits follow-up.

ACKNOWLEDGMENTS

Potential conflicts of interest. All authors report no conflicts of interest relevant to this article. All authors submitted the ICMJE Form for Disclosure of Potential Conflicts of Interest, and the conflicts that the editors consider relevant to this article are disclosed here.

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Received April 13, 2012; accepted July 18, 2012; electronically published October 26, 2012.

Presented in part: Fifth Decennial International Conference on Healthcare Associated Infections, Annual Meeting of the Society for Healthcare Epidemiology of America; Atlanta, Georgia; March 18–22, 2010.

Infect Control Hosp Epidemiol 2012;33(12):1268-1270

 0899-823X/2012/3312-0017$15.00. DOI: 10.1086/668428

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Natural Language Processing to Identify Foley Catheter–Days

Catheter-associated urinary tract infections (CAUTIs) are the most common hospital-acquired infections (HAIs), with an incidence of 3–7 infections per 1,000 catheter-days.[1] Currently, measurement of CAUTIs is primarily accomplished by manual chart review, a resource- and time-intensive process.[2] The critical elements required for diagnosis are also often missing; a recent survey of 719 US hospitals found that 56% did not have a system in place for monitoring urinary catheter use and that 74% did not monitor catheter duration.[3]

In the Veterans Affairs (VA) system, the robust electronic health record provides an obvious medium for automated capture of HAIs, including CAUTIs.[4] Our facility has instituted a CAUTI prevention bundle that includes structured documentation in daily nursing notes of catheter insertion, presence, and maintenance. However, the onerous task of manual chart review for calculation of catheter-days and

CAUTI rates remains problematic.[5,6] The aim of our study was to evaluate the performance of natural language processing (NLP) as a tool to identify patients with Foley catheters and calculate Foley catheter–days as an initial step toward automated CAUTI and HAI surveillance.

In this proof-of-concept study, we utilized an NLP tool that performed regular-expression matching on free text to identify the presence or absence of a urinary Foley catheter. The sample time period included 4 days before and after an index date, for a total of 9 days. Patients were included if their hospital stay on any of 3 acute care inpatient wards overlapped the sample period. The NLP tool scanned structured nursing notes from each shift and every study day for the word "Foley." Results were then compared to those of the standard manual method used at our facility, which involves daily tabulation of the number of patients with a Foley catheter on each ward. Sensitivity, specificity, and positive and negative predictive values were calculated. Any results that were discordant were reviewed manually to verify the accuracy of the nursing spreadsheet against that of the NLP tool database. This was a quality improvement project approved by the VA Boston Institutional Review Board.

There were 57 patients captured during the sample time period. On the basis of standard nursing data, 41 patients did not have a Foley catheter and 16 patients did have one (Figure 1). Of the 3 patients identified as having a Foley catheter by the nursing report but not identified by NLP, only 2 were found to actually have a Foley by manual chart review. All 41 patients identified as not having a Foley catheter by the nursing report were identified correctly by NLP. The sensitivity was 81%, the negative predictive value 93%, and the specificity and positive predictive values both 100%.

The maximum potential number of catheter-days for the 16 patients with Foley catheters was 144 (9 per patient). The nurse assessment calculated 58 catheter-days, while NLP identified 62 catheter-days. Eight Foley catheter–days identified by NLP were not identified by nursing assessment; 4 days were not found by NLP but were captured by the nursing report (Figure 1). The sensitivity and specificity were both greater than 90% for Foley catheter–day calculation. Manual review of charts found that NLP was correct for the presence or absence of a Foley catheter for 8 of 12 (66.7%) discordant days. The corrected specificity and sensitivity of NLP for identifying Foley catheter–days were 94.8% (55/58) and 98.8% (85/86), respectively.

Automated methods of surveillance for HAIs are important in an era of nonreimbursement and public reporting, because they have the potential to improve the accuracy, objectivity, and reliability of rates being used to compare hospitals.[4,6,7] Our study demonstrates high performance by an NLP tool for assessment of patients with Foley catheters and total Foley catheter–days, compared to standard manual review. In fact, this NLP approach was more accurate than our gold standard, correctly identifying 67% of Foley catheter–days that were discordant from the manually derived report.

Although others have used electronic records to calculate

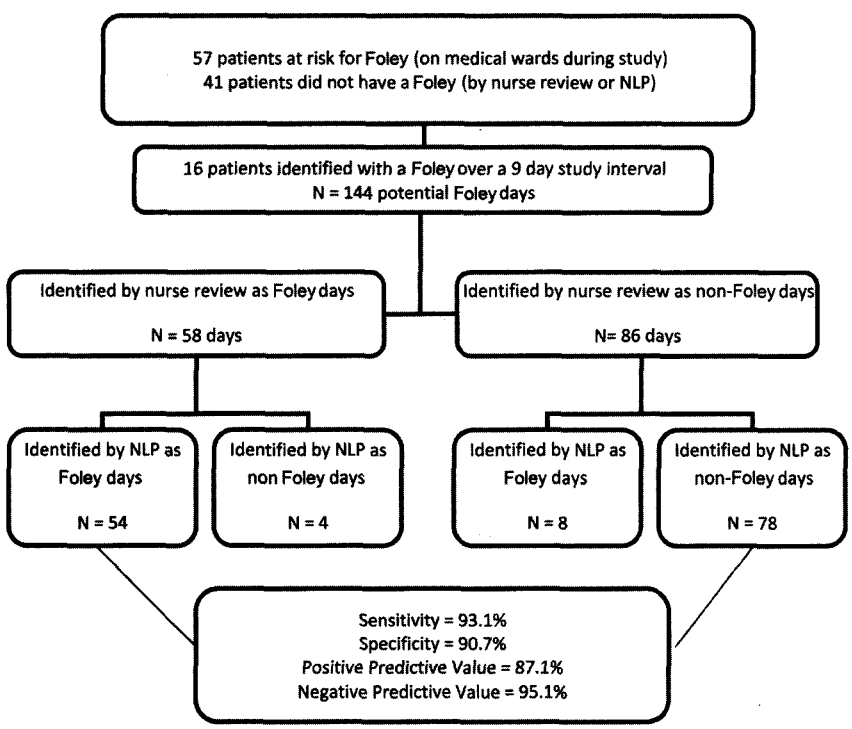

FIGURE 1. Number of patients having a Foley catheter and number of Foley catheter–days identified by natural language processing (NLP), as compared to the manual nurse review.

CAUTI rates, no published studies have been conducted in the VA setting or have reported use of an exportable tool such as NLP.[5,6] The benefits of NLP include the ability to capture specific symptoms from unstructured notes to improve diagnostic accuracy, the ability to be combined with other data-mining methods, and the potential to be generalized to other measures and implemented at other facilities.[8,9] Our study is limited by being primarily descriptive and being performed for a small sample size and in one institution. The framework of structured documentation of Foley catheter presence is key to the performance of our measurement tool. However, advanced NLP tools have the advantage of not requiring structured notes and are now being employed at our facility to capture unstructured data, such as patient symptoms.

The most intriguing aspect of automated CAUTI measurement is the ability to enhance prevention efforts by increasing awareness of a catheter presence and of whether a valid reason exists for continued use (by the simple action of having a clinician document the Foley catheter presence every day into a note).[10] This allows for quick and automated feedback to end users and could stimulate improvement efforts. This study moves us one step closer to automated measurement of CAUTI by using a novel tool that harnesses the power of electronic records in the largest integrated healthcare system in the United States.[4]

ACKNOWLEDGMENTS

We thank the Veterans Affairs Boston Health System quality management, nursing, patient safety, and infection prevention programs for their dedication to HAI prevention.

Potential conflicts of interest. All authors report no conflicts of interest relevant to this article. All authors submitted the ICMJE Form for Disclosure of Potential Conflicts of Interest, and the conflicts that the editors consider relevant to this article are disclosed here.

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Received April 2, 2012; accepted May 16, 2012; electronically published October 25, 2012.

Infect Control Hosp Epidemiol 2012;33(12):1270-1272

 0899-823X/2012/3312-0018$15.00. DOI: 10.1086/668424

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National Survey of Infection Preventionists: Policies for Discontinuation of Contact Precautions for Methicillin-Resistant *Staphylococcus aureus* and Vancomycin-Resistant Enterococcus

Methicillin-resistant *Staphylococcus aureus* (MRSA) and vancomycin-resistant enterococcus (VRE) are endemic in hospital settings. The Centers for Disease Control and Prevention recommend placement of patients with a history of MRSA and/or VRE colonization on contact precautions (CP).[1,2] While placement in private rooms is preferred, cohorting is an acceptable, common scenario in semiprivate room facilities. Although MRSA and VRE colonization clear spontaneously, no national guidelines exist to inform when or how CP may be discontinued.[1,2] We conducted a nationwide survey to gain insight into institutional CP practice.

We electronically surveyed members of the Association for Professionals in Infection Control and Epidemiology (APIC; Partners Human Research Committee P2010-001336). Participants received a link to the web-based survey on July 5, 2011, which remained active for 1 month. Study data were