

Feasibility of Audit and Feedback to Reduce Postoperative Urinary Catheter Duration

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BACKGROUND: Indwelling urinary catheter duration is an important risk factor for catheter-associated urinary tract infections (CAUTIs).

OBJECTIVE: To audit patient-level postoperative catheter duration and measure the impact of its feedback to nursing staff on postoperative catheter duration and CAUTI rates.

DESIGN: Preobservational and postobservational study.

SETTING: Two surgical units at an urban academic medical center.

PATIENTS: Postoperative patients with indwelling urinary catheters.

INTERVENTION: Audit and feedback of postoperative urinary catheter duration to nurses during an educational session.

MEASUREMENTS: Patient-level postoperative catheter duration obtained from electronic clinical documentation. Mean catheter duration and proportion of patients with postoperative catheter duration <3 days were determined.

RESULTS: Following the intervention, the mean postoperative catheter duration decreased (1.7-1.4 days [$P = 0.01$] on orthopedic surgery, and 2.6 to 2.2 days [$P = 0.01$] on general surgery). The proportion of patients with catheter duration <3 days increased significantly on orthopedic surgery (86-92% [$P = 0.04$]), and nonsignificantly on general surgery (56-63% [$P = 0.14$]). When adjusted for length of stay differences, the odds of catheter duration <3 days on general surgery increased from 1.38 ($P = 0.14$) to 1.69 ($P = 0.02$). The CAUTI rates did not significantly decrease. The rate on orthopedic surgery dropped from 8.9 infections per 1000 device-days to 0 (confidence interval [CI], -1.1 to 18.3); on general surgery the rate was constant at 7 infections per 1000 device-days (CI, -12.1 to 10.8).

CONCLUSIONS: Audit and feedback of aggregated patient-level urinary catheter duration determined from electronic documentation may prove effective in improving urinary catheter management for surgical patients. *Journal of Hospital Medicine* 2011;6:183-189. © 2011 Society of Hospital Medicine.

KEYWORDS: healthcare, quality assurance, urinary catheterization, urinary tract infections.

The ubiquitous urinary catheter is associated with 80% of hospital-acquired urinary tract infections (UTIs)¹—estimated to number one million annually—accounting for 40% of all nosocomial infections.^{2,3} The clinical consequences of these catheter-associated urinary tract infections (CAUTIs) are substantial and include prolonged hospital stay, bacteremia, and death.⁴ Despite the known risks of CAUTIs, it is estimated that 25% of hospitalized patients receive urinary catheters and that inappropriate urinary catheter use is widespread.⁵ Among catheterized patients, catheter duration is the most important modifiable risk factor for CAUTI. The excess risk of any bacteriuria accrues at a rate of 5% per catheter-day beyond the first 48 hours of catheterization.^{6,7} The reduction of catheter-days for a given patient is an important component of quality improvement efforts to reduce CAUTIs. Unfortunately, as of a 2005 survey, most

hospitals do not systematically track urinary catheter insertions and removals.⁸

The above concerns are highlighted for surgical patients among whom indwelling urinary catheter use is particularly high. In a 2001 sample of Medicare beneficiaries, 85% of major surgical patients had perioperative urinary catheters.⁹ In this population, postoperative catheter duration exceeded 48 hours in nearly 50%, despite concern that the risks of infection offset the benefits of continued catheterization after 24 hours to 48 hours postoperatively.^{4,7,10} Patients with catheters greater than 2 postoperative days had a 21% increased likelihood of in-hospital UTI, increased 30-day mortality, and decreased odds of discharge to home.⁹

To address the risk of CAUTI associated with excess urinary catheter days, The Centers for Medicare and Medicaid Services' (CMS) Surgical Care Improvement Project (SCIP)

added catheter removal on postoperative day 1 or 2 to its process measure set beginning in October 2009. SCIP is 1 of several high-profile surgical quality improvement programs that employs performance audit and feedback of patient-level process or outcome measures to address deficiencies in surgical care.^{11,12} In addition, audit and feedback of CAUTI rates has been used to successfully reduce CAUTIs in medical-surgical patients.¹³ The goal of our study was to audit patient-level postoperative urinary catheter duration and measure the impact of its feedback to nursing staff on postoperative catheter duration, CAUTI rates, and nurse's attitudes about CAUTI prevention.

Methods

Study Setting

The study was conducted within the orthopedic and general surgery units at the University of Colorado Hospital (UCH) Anschutz Inpatient Pavilion (AIP) in Aurora, CO. The AIP is a 425-bed tertiary care hospital which is the major teaching affiliate of the University of Colorado Medical School. The orthopedic surgery unit has 22 beds. The general surgery unit has 18 beds.

Study Population

All postoperative patients ≥ 18 years of age admitted to the general surgery unit and orthopedic surgery units who had perioperative placement of an indwelling urinary catheter were eligible for study inclusion. Exclusion criteria included: evidence of a chronic indwelling catheter or chronic intermittent catheterization, a urologic or gynecologic surgery. For patients undergoing more than one operation in the same hospitalization, only the final operation was included in the study. For patients who were recatheterized after initial catheter removal, only the first catheterization and removal were included in the study. The registered nurses (RNs) on the study floors ($n = 29$ orthopedic surgery and 31 general surgery nurses) were the targets of the audit and feedback intervention with education. The baseline period was September 1, 2007 through January 31, 2008 and, the follow-up period was April 1 through July 31, 2008.

Measures

The primary study outcome was postoperative urinary catheter duration measured in 2 ways:

1. Postoperative catheter duration in days defined as: the date of surgery subtracted from the date of catheter removal.
2. Postoperative catheter duration performance measure defined as: the number of patients with catheter removal before postoperative day three divided by the number of study eligible patients.

Both measures were calculated for each of the surgical units using data from all eligible study patients on the unit during the study period. For patients who were recatheterized

in the same hospitalization, only the days to the first removal were counted. If the catheter was removed on the day of surgery, the postoperative catheter duration was zero days.

Total device days were calculated as the sum of the postoperative catheter duration for every eligible patient for each unit. Total device days/hospital days was calculated as the total device days divided by the sum of the lengths of stay for every eligible patient for each unit.

Secondary Outcome

CAUTI was the secondary outcome. CAUTI was defined as a positive urine culture ($\geq 10^5$ organisms/cc of no more than 2 microorganisms) sent 3 or more days following admission and ≤ 7 days following catheter removal. The definition for CAUTI was based on that used by the National Healthcare Safety Network for infection control surveillance purposes at the time of the study and included both symptomatic CAUTI and asymptomatic bacteriuria. CAUTI was reported as the number of infections per 1000 catheter-days for eligible patients on each surgical unit for the baseline and follow-up data collection periods.

Additional Descriptive Variables

Descriptive variables included the patient's name, surgical procedure, surgeon, presence of a chronic indwelling catheter, date of admission to the floor, date of surgery, date of birth, and length of stay in days.

Data Collection

A professional research assistant (PRA) identified eligible patients on the 2 surgical units of interest and collected the number of postoperative urinary catheter days per patient using daily and weekly automated electronic queries of an EHR containing all nursing documentation on medical and surgical floors at UCH. These queries identified all patients on the floors of interest with urinary bladder elimination management documentation. Those with documented indwelling catheters were included in the study unless exclusion criteria were met. During the study period, the EHR was configured to provide the following documentation of urinary output management: date and location of catheter insertion, routine assessment of urinary output and devices, and date and time of catheter removal. At UCH, catheter insertion and removal are documented in the EHR for 93% and 88% of surgical patients, respectively. When documentation of catheter insertion was missing from the EMR, the operative note was reviewed electronically for documentation of insertion. If the operative note did not reference the insertion, it was presumed to have occurred perioperatively. Likewise, if there was no documentation of catheter removal, it was presumed to have occurred prior to documentation of urinary continence. The PRA abstracted additional information (surgical procedure and date) from the discharge abstracts and operative notes using a standardized data collection sheet.

TABLE 1. Patient Characteristics

Characteristic	Orthopedic Surgery			General Surgery			
	Baseline, n = 206	Follow-Up, n = 290	P Value		Baseline, n = 167	Follow-Up, n = 183	P Value
Age in years, mean (SD)	58.3 (15.6)	58.1 (14.7)	0.87		53.8 (16.1)	52.7 (15.7)	0.54
Male gender (%)	47.1	45.2	0.67		43.1	48.6	0.30
Length of stay in days, mean (SD)	4.0 (3.5)	3.7 (2.8)	0.22		6.6 (5.5)	8.5 (8.6)	0.02
Type of surgery (%)							
Knee	24.8	27.9	0.91	Gut	54.5	50.3	0.09
Hip	37.4	35.5		Other GI	22.8	32.8	
Spine	22.8	23.1		Non-GI	22.8	16.9	
Other Ortho	5.3	4.1					
Non-Ortho	9.7	9.3					

Abbreviations: GI, gastrointestinal, SD, standard deviation.

Laboratory-based surveillance was used to determine the incidence of CAUTIs in a manner similar to that employed by infection preventionists at UCH. The microbiology laboratory provided a monthly summary of all positive urine cultures for both study units. Positive culture results were cross-referenced with the catheter removal dates for all eligible study patients.

Validation

Validation of catheter documentation in the EHR was carried out on each of the 2 surgical units for a 2-week period at the outset of the data collection. During each day of the validation period, the PRA compared the EHR report with the charge nurse report on each floor. Any discrepancies regarding the presence or absence of the indwelling catheter were resolved by querying the patient's nurse directly. All patients with catheters during their inpatient stay were captured by EHR documentation. The daily EHR reports had a 91% agreement with a daily nursing query (reference standard) and a Kappa (percent agreement adjusted for chance agreement) of 0.77. Instances of disagreement were generally due to a lag in EHR documentation on the part of the nursing staff.

Audit and Feedback Intervention

An educational presentation was developed to cover the following topics: the definition and epidemiology of CAUTI, harms associated with CAUTI, risk factors for CAUTI, commonly accepted indications for indwelling catheters, and alternatives to catheters. In addition, the catheter duration performance measure was defined, followed by the feedback of unit-specific performance from the baseline data collection period. The presentation was made by the principal investigator to nursing staff on each of the 2 surgical units on 3 occasions per unit with days and times selected so as to reach as many unit nurses as possible. At the conclusion of each session, nurses were asked to brainstorm barriers to evidence-based management of indwelling catheters. Light refreshments and a 1/2 hour continuing education credit

were provided regardless of participation in the brainstorming session. Additionally, participants completed brief evaluations of the sessions.

Analyses

Descriptive data are reported as means and standard deviations for continuous variables and percentages for categorical variables. Outcome measures were calculated as defined above. For these comparisons, we used *t*-tests for continuous variables and chi-square tests for dichotomous variables. We used Cochran-Mantel-Haenszel to test for trend for categorical variables. Confidence intervals were calculated for the incidence rate differences based on Poisson approximations. Analyses were completed using SAS Statistical Software Version 9.2.

This study was approved by the Colorado Multiple Institutional Review Board. Waivers of Health Insurance Portability and Accountability Act (HIPAA) and informed consent were obtained for study patients. Nurses participating in the educational sessions provided informed consent.

Results

During the study period there were a total of 1657 surgeries on the 2 study units during the baseline and follow-up periods. After exclusions for urologic or gynecologic surgery (271), no indwelling catheter for surgery (505), or first surgery of 2 or more during the hospitalization (31), there were 846 eligible surgeries (51%).

Table 1 describes the population for the baseline and follow-up periods for orthopedic and general surgery patients. Within each unit, the surgical populations were comparable during the baseline and follow-up periods with the exception that the mean length of stay for eligible general surgery patients was significantly shorter in the baseline period as compared to the follow-up period (6.6 vs. 8.5 days, *P* = 0.02). Cases on the orthopedic surgery unit were predominantly knee, hip and spine surgeries (85.9%), while those on the general surgery unit were predominantly gut and other gastrointestinal (GI) procedures (80.3%).

TABLE 2. Nursing-Identified Barriers to Evidence-Based Care of Catheters

Domain	Orthopedic Surgery	General Surgery
Communication	Communication among teams	Occasional need to call MD for order
Patient Comfort	Discomfort first overnight postop without catheter; discomfort of straight catheters	Discomfort and embarrassment associated with straight catheters; patient request for indwelling catheter
Clinical concerns	Removal POD 1 too soon	Need to monitor I/Os in patients with low output
Equipment		Portable ultrasound on a different floor
Policies and Procedures		
1. Epidural anesthesia		Duration of epidural/delay post epidural removal
2. Straight catheters	Risk of infection	Risk of trauma; infection
3. Management of Urinary Retention	No standardized protocol for urinary retention.	Need for traumatic reinsertion of catheter.
Skills	Perineal care; catheter care	Perineal care

Abbreviations: MD, medical doctor; POD, postoperative day.

TABLE 3. Measures of Indwelling Urinary Catheter Duration and CAUTI Rates

Measure	Orthopedic Surgery			General Surgery		
	Baseline, n = 206	Follow-Up, n = 290	P Value	Baseline, n = 167	Follow-Up, n = 183	P Value
Postoperative catheter duration in days (mean, SD)	1.70 (1.24)	1.44 (0.85)	0.01	2.64 (1.85)	2.19 (1.40)	0.01
Postoperative catheter duration performance measure (%)	86	92	0.04	56	63	0.14
Total catheter days	350	418	—	441	401	—
Catheter days/1000 hospital days	423	394	ns*	398	259	s*
Catheter-associated UTIs	3	0	—	3	3	—
Catheter-associated UTI rate (infections/1000 device days)	8.6	0	ns*	6.8	7.5	ns*

Abbreviations: CAUTI, catheter-associated urinary tract infection; ns, not sufficient; SD, standard deviation.

The Intervention

The educational intervention and feedback was received by two-thirds of registered nurses on each unit and was rated highly by participants. A total of 79% of nurses agreed or strongly agreed that the information provided was relevant to their daily practice and 42% strongly agreed that they would change their practice based on the presentation. Barriers to evidence-based use of urinary catheters identified by surgical nurses on each unit are shown in Table 2. They included the following domains: communication, patient concerns, clinical concerns, equipment, policies and procedures, and skills. General surgery and orthopedic surgery nurses identified different concerns arising from the different patient populations and surgeries cared for on each unit.

Baseline—Follow-Up Comparison

Table 3 describes the measures of urinary catheter use for each surgical population for both data collection periods. On both units, measures of catheter duration were improved following the education and feedback intervention. For the orthopedic unit, mean postoperative catheter duration was reduced from 1.7 to 1.4 days ($P = 0.01$) and the proportion of patients with catheter removal before day 3 was increased from 86% to 92% ($P = 0.04$). For the general surgery unit, mean postoperative catheter duration was reduced from 2.6

to 2.2 days ($P = 0.01$) and the proportion of patients with catheter removal before day 3 was increased from 56% to 63% ($P = 0.14$). When the general surgery measures were adjusted to account for the difference in length of stay between the 2 time periods, the odds of meeting the performance measure at follow-up compared to baseline increased from unadjusted odds of 1.38 ($P = 0.14$) to adjusted odds of 1.69 ($P = 0.02$).

Figure 1a and b are histograms of the frequency of cases having a given postoperative catheter duration in days. The dark bars show the baseline distribution and the light bars show the follow-up distribution. Although the number of patients in the follow-up period is greater than for the baseline period for the orthopedic surgery cohort, the images are instructive. In both groups of patients, but most notably in the general surgery population, the reduction in catheter measures resulted from a left shift in the frequency distribution, both for the longer duration outliers (removing the tail of each plot) and for the shorter duration catheters ($\ll 3$ days), increasing the proportion of catheters removed on postoperative day 1.

CAUTIs

The CAUTI rate on the orthopedic surgery unit demonstrated a nonsignificant decline from 8.9 to 0 infections per

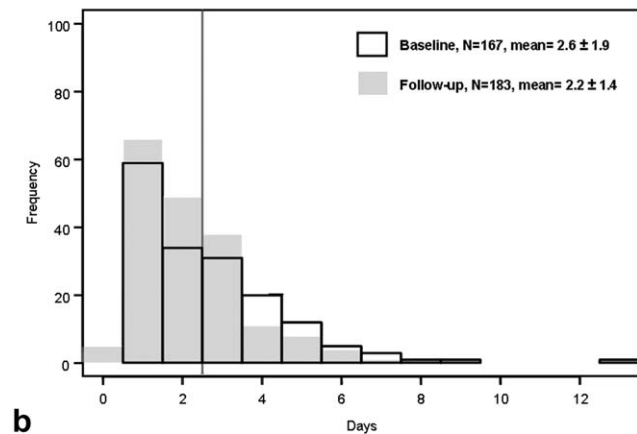
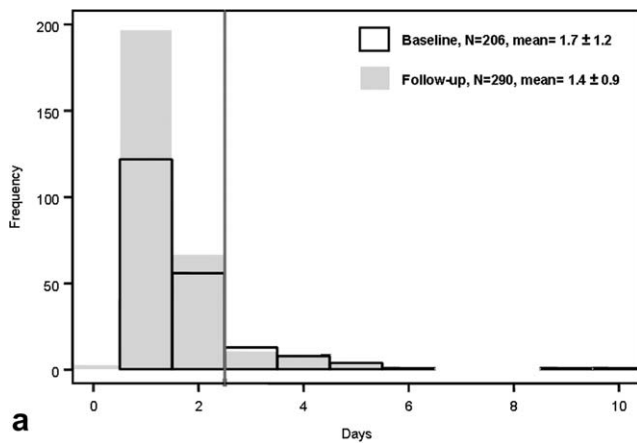


FIGURE 1. A: Histogram of postoperative catheter duration in days for orthopedic surgery. B: Histogram of postoperative catheter duration in day for general surgery.

1000 device days, and on the general surgery unit the rate was constant at approximately 7 infections per 1000 device days.

Discussion

This preobservational and postobservational study found that audit and feedback of patient-level postoperative urinary catheter duration delivered in the context of an educational intervention and brainstorming session was temporally associated with clinically meaningful reductions in urinary catheter duration. In so doing, we demonstrated the feasibility of collecting patient level urinary catheter duration, and delivering it in a manner that had utility for front-line staff. Our results are consistent with the quality improvement literature which demonstrates that audit and feedback is a successful quality improvement strategy in many contexts and may be as good as more complex interventions at increasing adherence to the performance of process measures for surgical infection prevention.¹⁴ Two large national programs, the VA National Surgical Quality Improvement Program (NSQIP) and SCIP, use audit and feedback as the backbone of their large-scale quality improvement strategies with promising results.^{11,12}

Given that the 2 study units were so different in practice patterns regarding urinary catheter management and nursing-identified barriers to evidence-based care, this work suggests that urinary catheter management may pose unique challenges for different clinical areas and provides a caution that one-size-fits-all interventions for the rationalization of urinary catheter management and reduction of CAUTIs may be of limited effectiveness in the absence of local tailoring. As such, audit and feedback is well-suited to this purpose as more proscriptive quality improvement strategies may meet with a variety of implementation challenges.

The impact of our intervention on CAUTI rates was not significant. There are several possible explanations for this finding. First, the study was not powered to detect a difference in CAUTI rates given the low infection rate at our institution. However, we cannot exclude the possibility that a reduction in mean catheter duration of one-third to one-half of a day is insufficient to impact CAUTI rates in postoperative patients, particularly when many of the follow-up patients still had postoperative catheter duration $\gg 2$ days—the timeframe beyond which bacterial colonization of the catheter begins. While both study units had similar increases in postoperative catheter duration, the UTI rate was only decreased in the orthopedic surgery group which had much higher rates of postoperative catheter duration $\ll 2$ days at baseline.

In recent years, there has been a renewed focus on the eradication of hospital-acquired infections prompted by intense interest from the public, federal and state legislators, and others.^{15,16} The CMS has recently used the revamping of the Inpatient Prospective Payment System (IPPS) as an opportunity to align financial incentives so that reimbursements for claims with certain hospital-acquired conditions, including CAUTIs, will be reduced to that of the reimbursement of the same claim without the presence of the complication.¹⁷ This move is just one of several strategies to motivate hospitals and clinicians to address the pervasive problem of hospital-acquired infection.

As urinary catheters are intimately linked to hospital-acquired UTI, a focus of reduction efforts on catheter use is appropriate. The National Quality Forum (NQF) endorsed a postoperative catheter duration quality measure which was incorporated by the CMS's SCIP in late 2009.¹⁸ As a result, every hospital in the country that performs surgery and participates in the Medicare program is now tasked with determining patient-level urinary catheter duration for selected surgical patients. This move represents a departure from current recommendations from the Centers for Disease Control and Prevention (CDC) and its National Healthcare Safety Network^{19,20} which endorse the measurement of a catheter utilization ratio (urinary catheter days/patient days) for patient care units, but does not endorse any patient-level utilization measures. In this instance, the use of patient-level data may be better suited to quality improvement interventions such as audit and feedback because of its clinical relevance to frontline providers. However, it may also increase the data collection burden on

hospitals. Notably, the measurement of postoperative catheter duration in this study was semiautomated using queries of an EHR. Such an approach can significantly reduce the data collection burden for this process measure and is consistent with national initiatives to integrate EHRs with quality improvement initiatives going forward.²¹

Our study has several limitations. This study took place in the year following the announcement of a high profile Medicare rule change regarding payment for hospital-acquired harms. Certainly, the uncontrolled prestudy and poststudy design does not allow for the assessment of the impact of our intervention independent of this context. We are unable, therefore, to attribute the observed reduction solely to the intervention. Additionally, we did not follow postoperative urinary catheter duration beyond the immediate follow-up period. It is anticipated that the impact of an audit and feedback intervention may diminish over time without a mechanism for repeated feedback. Certainly the sustainability of such repeated feedback in a single institution would be improved with an appropriately configured EHR.

In addition, we have reliable data on catheter reinsertions only from the follow-up period. While the rates of reinsertions we recorded (0.7% on orthopedic surgery and 2.7% on general surgery) were lower than expected based on the literature,²² we are unable to determine if our intervention led to increases in postoperative urinary retention.

This study was limited to 2 surgical units of a single academic medical center and therefore the urinary catheter utilization patterns may not be representative of other patient populations at other institutions. However, the urinary catheter patterns were comparable to those identified in our prior work in a national sample of Medicare patients undergoing elective surgery.⁹

Finally, the field of CAUTI prevention has evolved rapidly since this study was performed. In particular, the surveillance definition of CAUTI was altered twice by the CDC in December of 2008 and March of 2009. In addition, the Infectious Diseases Society of America issued a new definition of CAUTI in February of 2010.²³ All of these changes highlight the difference between asymptomatic bacteriuria (ASB) and symptomatic CAUTI. However, the surveillance definition in use at the time of this study did not make this distinction. Therefore, we are unable to comment on the relative occurrence of ASB versus symptomatic CAUTI under the new definitions.

Rational urinary catheter use is a central component of CAUTI prevention efforts.²⁴ We describe the use of patient-level urinary catheter use in an audit and feedback intervention to frontline staff that was associated with reductions in urinary catheter duration. To do so, we employed a methodology for tracking urinary catheter use patterns that can provide important data for infection preventionists and frontline providers in efforts to improve urinary output management. This promising approach merits further study as an adjunct to current efforts to rationalize urinary catheter utilization and reduce CAUTIs. In the current environ-

ment, having the right data is a powerful aide for ongoing performance improvement.

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References

1. Krieger JN, Kaiser DL, Wenzel RP. Urinary tract etiology of bloodstream infections in hospitalized patients. *J Infect Dis*. 1983;148:57–62.
2. Haley RW, Hooton TM, Culver DH, et al. Nosocomial infections in US hospitals, 1975–1976: estimated frequency by selected characteristics of patients. *Am J Med*. 1981;70:947–959.
3. Haley RW, Culver DH, White JW, Morgan WM, Emori TG. The nationwide nosocomial infection rate: a new need for vital statistics. *Am J Epidemiol*. 1985;121:159–167.
4. Saint S. Clinical and economic consequences of nosocomial catheter-related bacteriuria. *Am J Infect Control*. 2000;28:68–75.
5. Jain P, Parada J, David A, Smith L. Overuse of the indwelling urinary tract catheter in hospitalized medical patients. *Arch Intern Med*. 1995;155:1425–1429.
6. Schaeffer AJ. Catheter-associated bacteriuria. *Urol Clin North Am*. 1986;13:735.
7. Stamm WE. Guidelines for prevention of catheter-associated urinary tract infections. *Ann Intern Med*. 1975;82:386.
8. Saint S, Kowalski CP, Kaufman SR, et al. Preventing hospital-acquired urinary tract infection in the united states: a national study. *Clin Infect Dis*. 2008;46:243–250.
9. Wald HL, Ma A, Bratzler DW, Kramer AM. Indwelling urinary catheter use in the postoperative period: analysis of the national surgical infection prevention project data. *Arch Surg*. 2008;143:551–557.
10. Skelly JM, Guyatt GH, Kalbfleisch R, Singer J, Winter L. Management of urinary retention after surgical repair of hip fracture. *Can Med Assoc J*. 1992;146:1185–1188.
11. Khuri SF, Daley J, Henderson WG. The comparative assessment and improvement of quality of surgical care in the department of veterans affairs. *Arch Surg*. 2002;137:20–27.
12. Bratzler DW. The surgical infection prevention and surgical care improvement projects: promises and pitfalls. *Am Surg*. 2006;72:1010–1016.
13. Goetz AM, Kedzif S, Wagener M, Muder RR. Feedback to nursing staff as an intervention to reduce catheter-associated urinary tract infections. *Am J Infect Control*. 1999;27:402–424.
14. Kritchevsky SB, Braun BI, Bush AJ, et al. The effect of a quality improvement collaborative to improve antimicrobial prophylaxis in surgical patients. *Ann Intern Med*. 2008;149:480.
15. Wald HL, Kramer AM. Nonpayment for harms resulting from medical care: catheter-associated urinary tract infections. *JAMA*. 2007;298:2782–2784.
16. Kaiser Family Foundation. Hospital-based infections reporting requirements, 2008. Available at: www.KaiserFamilyFoundation.org/HealthFacts.org. Accessed August 25, 2010.
17. Centers for Medicare and Medicaid Services, Department of Health and Human Services. Medicare Program: Changes to the Hospital Inpatient Prospective Payment Systems and Fiscal Year 2008 Rates. CMS-1390-F-8-1-2007.
18. Centers for Medicare and Medicaid Services, Department of Health and Human Services and The Joint Commission. Specifications Manual for

- National Hospital Inpatient Quality Measures, Discharges 10/1/09 (4Q09) through 3/31/10 (1Q10). 5-4-2009.
19. Gould CV, Umscheid CA, Agarwal RK, Kuntz G, Peques DA, and the Healthcare Infection Control Practices Advisory Committee. Guideline for the Prevention of Catheter-associated Urinary Tract Infections, 2009. Centers for Disease Control and Prevention. 1-22-2010.
 20. Centers for Disease Control and Prevention. NHSN Patient Safety Component Key Terms. 1-22-2010.
 21. Blumenthal D. Stimulating the adoption of health information technology. *N Engl J Med*. 2010;360:1477-1479.
 22. Lau H, Lam B. Management of postoperative urinary retention: a randomized trial of in-out versus overnight catheterization. *ANZ J Surg*. 2004;2004:658-661.
 23. Hooton TM, Bradley SF, Cardenas DD, et al. Diagnosis, prevention, and treatment of catheter-associated urinary tract infection in adults: 2009 International Clinical Practice Guidelines from the Infectious Diseases Society of America. *Clin Infect Dis*. 2010;50:625-663.
 24. Lo E, Nicolle L, Classen D, et al. Strategies to prevent catheter-associated urinary tract infections in acute care hospitals. *Infect Control Hosp Epidemiol*. 2008;29:S41-S50.