

Effect of Nonpayment for Hospital-Acquired, Catheter-Associated Urinary Tract Infection

A Statewide Analysis

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Background: Most (59% to 86%) hospital-acquired urinary tract infections (UTIs) are catheter-associated urinary tract infections (CAUTIs). As of 2008, claims data are used to deny payment for certain hospital-acquired conditions, including CAUTIs, and publicly report hospital performance.

Objective: To examine rates of UTIs in adults that are coded in claims data as hospital-acquired and catheter-associated events and evaluate how often nonpayment for CAUTI lowers hospital payment.

Design: Before-and-after study of all-payer cross-sectional claims data.

Setting: 96 nonfederal acute care Michigan hospitals.

Patients: Nonobstetric adults discharged in 2007 (*n* = 767 531) and 2009 (*n* = 781 343).

Measurements: Hospital rates of UTIs (categorized as catheter-associated or hospital-acquired) and frequency of reduced payment for hospital-acquired CAUTIs.

Results: Hospitals frequently requested payment for non-CAUTIs as secondary diagnoses: 10.0% (95% CI, 9.5% to 10.5%) of discharges in 2007 and 10.3% (CI, 9.8% to 10.9%) in 2009.

Hospital rates of CAUTI were very low: 0.09% (CI, 0.06% to 0.12%) in 2007 and 0.14% (CI, 0.11% to 0.17%) in 2009. In 2009, 2.6% (CI, 1.6% to 3.6%) of hospital-acquired UTIs were described as CAUTIs. Nonpayment for hospital-acquired CAUTIs reduced payment for 25 of 781 343 (0.003%) hospitalizations in 2009.

Limitations: Data are from only 1 state and involved only 1 year before and after nonpayment for complications. Hospital prevention practices were not examined.

Conclusion: Catheter-associated UTI rates determined by claims data seem to be inaccurate and are much lower than expected from epidemiologic surveillance data. The financial impact of current nonpayment policy for hospital-acquired CAUTI is low. Claims data are currently not valid data sets for comparing hospital-acquired CAUTI rates for the purpose of public reporting or imposing financial incentives or penalties.

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Since October 2008, the Centers for Medicare & Medicaid Services (CMS) no longer pays hospitals to treat specific, “reasonably preventable” hospital-acquired complications as part of a value-based purchasing plan to encourage hospitals to improve patient safety and reduce Medicare spending (1–3). Administrative discharge claims data (submitted by hospitals to request payment) are now used to deny payment for these complications and publicly report and compare hospitals by complication rates.

The CMS rules are complex for identifying these complications in administrative discharge data (4, 5). For example, for the first complication chosen for nonpayment (hospital-acquired, catheter-associated urinary tract infection [CAUTI]), multiple codes must each be listed accurately to trigger nonpayment for the UTI: a diagnosis code for UTI, the code for urinary catheter-associated inflammation or infection (996.64), and both codes need to be labeled as not present on admission (indicating that the CAUTI was hospital-acquired). Even if a hospital-acquired condition is identified, hospitals can continue to receive extra payment if other patient comorbid conditions, such as heart failure, are listed as diagnoses (6). Accordingly, the financial impact of nonpayment for hospitals and payers will be influenced by how hospitals describe CAUTIs and comorbid conditions using diagnosis codes in claims data. Public reporting of hospital-acquired CAUTI rates on

Medicare Hospital Compare (www.hospitalcompare.hhs.gov) also follows similar coding conventions as the rules for payment. Case examples of how a UTI diagnosis affects hospital payment and public reporting are provided in **Appendix 1** and **Appendix Table 1** (available at www.annals.org).

Surveillance data suggest that 4.5 hospital-acquired infections occur per 100 hospitalizations and that 32% of them have a urinary tract source (7). Most hospital-acquired UTIs (59% to 86%) are catheter-associated (8–10). However, on the basis of previous work (4), we hypothesized that the catheter code in claims data was rarely applied to describe UTIs as catheter-associated. We designed a statewide study to investigate hospital rates of non-catheter-associated UTIs (non-CAUTIs) and CAUTIs before and after implementation of nonpayment for hospital-acquired CAUTIs from claims data and assessed the financial impact of nonpayment for hospital-acquired CAUTIs.

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Context

The Centers for Medicare & Medicaid Services limits payment for key “reasonably preventable” complicating conditions acquired during a hospital stay. Catheter-associated urinary tract infection (CAUTI), coded in discharge claims data as hospital-acquired, was the first condition targeted for such nonpayment.

Contribution

These data from 96 Michigan hospitals showed that hospitals frequently requested payment for non-CAUTIs. These infections were rarely coded as hospital-acquired or catheter-associated, although surveillance data sets show that such infections are common. Nonpayment for hospital-acquired CAUTIs lowered payment for very few hospitalizations (0.003 %).

Implication

Discharge claims are inadequate for identifying hospital-acquired CAUTIs. Nonpayment based on such claims has little financial impact on hospital payment.

—The Editors

METHODS**Study Design**

We conducted a retrospective before-and-after study using administrative data for all adult patients discharged from acute care hospitals in Michigan in 2007 and 2009 using the Healthcare Cost and Utilization Project State Inpatient Database, sponsored by the Agency for Healthcare Research and Quality (11). This claims database contained all data from inpatient discharge abstracts generated by hospitals to request payment for each discharge in 2007 and 2009. Data were translated into a uniform format to facilitate comparisons and protect patient identity. The claims data were generated by hospital coders who reviewed medical records to guide selection of diagnosis, procedure, and demographic codes to describe each hospitalization, in accordance with federal guidelines (12). Hospitals submitted Michigan discharge data first to the Michigan Health & Hospital Association, which decided which data elements could be released publicly through the Healthcare Cost and Utilization Project Central Distributor. Few data elements were missing in the released information (Figure 1). This study received approval from the Institutional Review Board for Human Subjects at the University of Michigan.

Study Population

Figure 1 depicts application of patient and hospital inclusion and exclusion criteria that were used to construct the analytic data set. Our study population included non-obstetric adult patients (aged ≥ 18 years) who had a hospital stay of 2 days or longer. We did analyses specific to Medicare patients and analyses for an all-payer population because the policy that had been initiated only for Medi-

care has expanded to other payers, including state Medicaid programs (13) and Blue Cross Blue Shield nationwide (14).

We excluded hospitals not affected by the Hospital-Acquired Conditions Initiative, such as long-term care, rehabilitation, and psychiatric facilities and critical access, Veterans Affairs, and children's hospitals. When comparing hospital rates of non-CAUTIs and CAUTIs, we included only hospitals with data available in both 2007 and 2009 and with 200 or more discharges of adult patients. We identified safety net hospitals as those with a Medicaid caseload 1 or more SD above the state average (15–19).

CAUTI or Hospital-Acquired UTI Identification

Non-CAUTIs were identified by having at least 1 of 10 UTI diagnosis codes (Appendix Table 2, available at www.annals.org), without an additional catheter-association code (996.64). Catheter-associated UTIs were identified by the code for urinary catheter-associated inflammation or infection (996.64), with or without an additional UTI code, in accordance with the Medicare Hospital-Acquired Conditions Initiative policy.

The variable to identify a diagnosis as present on admission versus acquired in the hospital (Appendix Table 3, available at www.annals.org) was mandated nationally for discharges after 1 October 2007. Thus, we were able to identify non-CAUTIs and CAUTIs as hospital-acquired or present on admission in the postpolicy 2009 data set. Hospital-acquired non-CAUTIs and CAUTIs were identified in the 2009 data set with the present-on-admission indicator coded as N (not present on admission) or U (could not be determined because of insufficient documentation, which also results in nonpayment). To identify hospital-acquired CAUTIs, the catheter code 996.64 also had its associated present-on-admission indicator coded as N or U.

Assessing Hospital Rates of Non-CAUTIs and CAUTIs

We assessed and compared each hospital's rates of non-CAUTIs and CAUTIs as secondary diagnoses in both 2007 and 2009 and as hospital-acquired or present-on-admission conditions in 2009. A hospital's rates for non-CAUTIs and CAUTIs were calculated as the percentage of each hospital's discharged adult patients with these diagnoses. We also analyzed (Appendix 2 and Appendix Table 4, available at www.annals.org) how many hospital-acquired CAUTIs were noted in the first 8 secondary diagnoses, as is the current standard for public reporting (6).

Assessing Effect of CAUTIs on Hospital Payment

Using the postpolicy 2009 data set, we assessed how often nonpayment for hospital-acquired CAUTIs affected the payment received by the hospital. This analysis was done by using the 3M MS Grouper Software (3M Health Information Systems, Wallingford, Connecticut), which applies the diagnosis-related group (DRG) that determines hospital payment for each hospitalization record by using an algorithm that incorporates diagnosis and procedure

codes and patient characteristics. First, we obtained the DRG assigned at baseline by using all of the secondary diagnoses in the 2009 data set, with minor modifications to ensure that the same DRG version was applied to all discharges in the year. Then, we modified hospital-acquired CAUTI cases (which could not increase payment) to be coded as present-on-admission CAUTI cases (which may lead to a higher-paying DRG) and then used the software to reassign the DRG. We identified hospitalizations where nonpayment for the hospital-acquired CAUTI affected payment by a change in DRG.

Statistical Analysis

Descriptive statistics and 95% CIs are reported. A paired *t* test was used to compare prepolicy (2007) with postpolicy (2009) hospital rates of non-CAUTIs and CAUTIs. Analyses were conducted in Stata/MP, version 11.2 (Stata Corp, College Station, Texas).

Role of Funding Source

This study was funded by the Blue Cross Blue Shield of Michigan Foundation. The funding source provided some recommendations on the study design but was not involved in the conduct, interpretation, or reporting of

the results or the decision to submit the manuscript for publication.

RESULTS

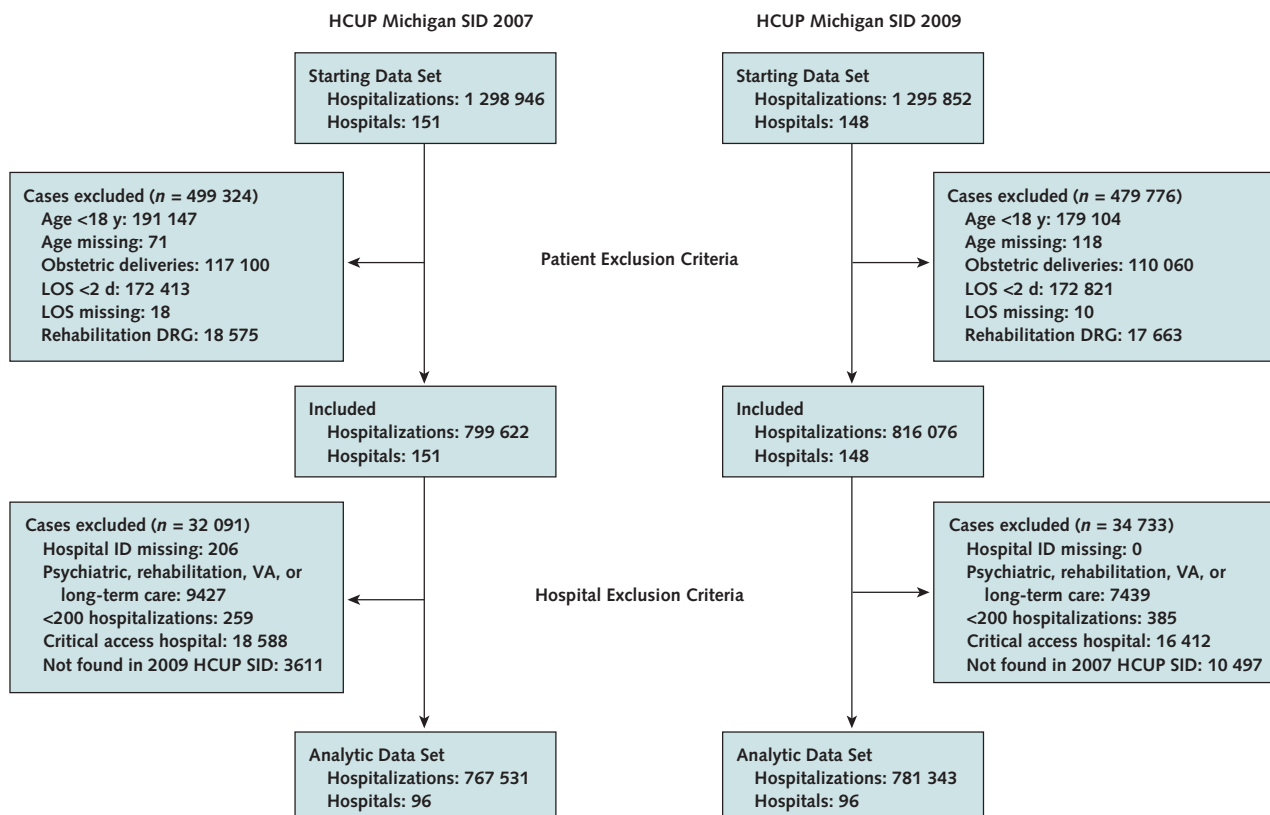
Cohort Characteristics

There were 767 531 discharges of adult patients at 96 Michigan hospitals in 2007 and 781 343 discharges in the same hospitals in 2009 (Figure 1). The Table compares hospital-level rates and characteristics for discharges with non-CAUTI and CAUTI diagnoses.

Hospital Rates of CAUTIs or Hospital-Acquired UTIs

All 96 hospitals requested payment for secondary-diagnosis non-CAUTIs. The rate for this diagnosis (that is, the proportion of the hospital's discharges of adult patients with the indicated diagnosis) ranged from 5.2% to 17.1% (mean, 10.0% [CI, 9.5% to 10.5%]) of each hospital's discharges in 2007 and 5.0% to 20.2% (mean, 10.3% [CI, 9.8% to 10.9%]) of the discharges in 2009. Hospital rates of secondary-diagnosis CAUTIs ranged from 0% to 1.10% (mean, 0.09% [CI, 0.06% to 0.12%]) of discharges in 2007 and 0% to 0.95% (mean, 0.14% [CI, 0.11% to 0.17%]) in 2009.

Figure 1. Study flow diagram.



DRG = diagnosis-related group; HCUP = Healthcare Cost and Utilization Project; LOS = length of stay; SID = State Inpatient Database; VA = Veterans Affairs.

Table. Hospital Discharge Characteristics Before and After HACI Implementation, by Diagnosis*

Characteristic	Volume, <i>n</i>	Rate of Diagnosis, %†	Length of Stay, <i>d</i>	Secondary Diagnoses per Discharge, <i>n</i>	Medicare Discharges, %
2007, before HACI implementation					
All discharges					
Mean (SD)	7995.1 (7706.1)	NA	5.3 (0.9)	8.6 (2.0)	58.8 (10.1)
Range	401.0–39 850.0	NA	3.4–7.5	3.7–16.2	11.8–74.3
Secondary diagnosis of non-CAUTI					
Mean (SD)	825.2 (836.5)	10.0 (2.6)	7.5 (2.3)	12.2 (2.9)	75.3 (11.9)
Range	25.0–4368.0	5.2–17.1	3.3–16.4	5.7–21.2	12.0–92.2
Secondary diagnosis of CAUTI					
Mean (SD)	8.4 (14.7)	0.09 (0.14)	9.9 (4.8)	15.5 (4.4)	79.6 (23.7)
Range	0–107.0	0–1.10	2.0–25.2	4.0–28.0	0–100.0
2009, after HACI implementation					
All discharges					
Mean (SD)	8139.0 (7940.7)	NA	5.1 (0.9)	9.8 (2.0)	59.5 (10.4)
Range	253.0–40385.0	NA	3.1–8.1	6.0–15.4	9.1–76.7
Secondary diagnosis of non-CAUTI					
Mean (SD)	864.5 (861.5)	10.3 (2.6)	7.0 (2.0)	13.6 (2.8)	74.5 (12.0)
Range	21.0–4375.0	5.0–20.2	3.6–12.6	8.5–20.3	0–91.5
POA non-CAUTI‡					
Mean (SD)	674.5 (666.0)	8.5 (3.1)	6.2 (1.3)	13.3 (2.7)	74.7 (12.1)
Range	0–3290.0	0–19.0	3.5–9.3	8.5–20.1	0–91.2
Hospital-acquired non-CAUTI‡					
Mean (SD)	140.8 (195.1)	1.3 (0.9)	11.7 (4.7)	15.6 (3.8)	72.5 (15.7)
Range	0–1095.0	0–4.2	3.3–26.8	8.7–24.8	0–100.0
Secondary diagnosis of CAUTI					
Mean (SD)	13.5 (21.9)	0.14 (0.15)	9.1 (4.2)	17.7 (4.6)	77.0 (23.5)
Range	0–151.0	0–0.95	2.5–21.8	8.0–27.3	0–100.0
POA CAUTI‡					
Mean (SD)	9.6 (14.7)	0.10 (0.13)	7.5 (2.9)	17.9 (4.4)	81.0 (24.2)
Range	0–82.0	0–0.88	2.0–18.0	8.0–29.0	0–100.0
Hospital-acquired CAUTI‡					
Mean (SD)	3.3 (9.8)	0.03 (0.05)	14.2 (10.4)	18.7 (6.0)	73.0 (31.9)
Range	0–92.0	0–0.34	2.0–68.5	4.0–29.0	0–100.0

CAUTI = catheter-associated urinary tract infection; HACI = Hospital-Acquired Conditions Initiative; NA = not applicable; POA = present-on-admission.

* Data are from the 2007 and 2009 Michigan Healthcare Cost and Utilization Project State Inpatient Database (11).

† Calculated as the proportion of each hospital's adult discharges with the indicated diagnosis.

‡ POA and hospital-acquired rates do not sum to total; the difference is the rate of cases coded with an invalid POA code.

Figure 2 illustrates how individual hospital rates of non-CAUTIs and CAUTIs compared for Michigan hospitals in 2009. Of note, 18 hospitals (19%) in 2007 and 8 (8%) in 2009 did not use the catheter-association code for any hospitalization record (including the principal diagnosis); these hospitals had similar proportions of discharges (8.6% in 2007 and 8.7% in 2009) with a secondary diagnosis of non-CAUTI. Fifty-seven percent of hospitals in 2007 and 48% in 2009 requested payment for 5 or fewer CAUTIs as secondary diagnoses.

Figure 2 also illustrates the changes for individual hospital rates of non-CAUTIs and CAUTIs, from 2007 (pre-policy) to 2009 (postpolicy). The average hospital difference in prepolicy and postpolicy non-CAUTI rates was 0.3% (CI, −0.01% to 0.7%). Hospital rates of CAUTI as a secondary diagnosis increased by only 0.05% on average (CI, 0.02% to 0.08%). Compared with 85 non-safety net hospitals (**Appendix Table 5**, available at www.annals.org), the 11 safety net hospitals had similar rates of non-CAUTIs and CAUTIs in 2009.

In 2009, most non-CAUTIs were described as present on admission (**Table**). The mean rate across hospitals for

present-on-admission non-CAUTI diagnosis was 8.5% (CI, 7.9% to 9.1%), whereas only 1.3% (CI, 1.1% to 1.5%) of discharges were described as hospital-acquired non-CAUTIs. Of note, hospitals did not provide a valid code to identify a UTI as present or not on admission for 0.5% of the diagnoses (CI, 0.1% to 0.9%).

Hospital-acquired CAUTIs were uncommon in claims data; the mean rate of hospital discharges with this diagnosis was 0.03% (CI, 0.02% to 0.04%). Forty-five hospitals (47%) coded 0 Medicare hospitalizations with a diagnosis of hospital-acquired CAUTI. Of all hospital-acquired UTIs, few (mean, 2.6% [CI, 1.6% to 3.6%]) were described as CAUTIs.

The **Appendix Figure** (available at www.annals.org) illustrates how the proportion of non-CAUTIs and CAUTIs identified as hospital-acquired or present on admission varied by each hospital. Focusing on hospital-acquired events only, **Figure 3** illustrates hospital rates of hospital-acquired non-CAUTIs and CAUTIs, in order of CAUTI rates. Hospital-acquired CAUTI rates in 2009 ranged from 0% of discharges in 39 (41%) hospitals to 0.34% of discharges, with 0%, 0.02%, and 0.04% of dis-

charges identifying the second, third, and fourth quartiles of hospital rates, respectively. Depending on the number of annual discharges, a single case of hospital-acquired CAUTI could move a hospital from the lowest (that is, best) quartile of infection rates to the second, third, or fourth quartile. Comparing the hospital-acquired rates for non-CAUTIs and CAUTIs of **Figure 3** illustrates that hospital rates of hospital-acquired non-CAUTIs have little correlation with rates of hospital-acquired CAUTIs.

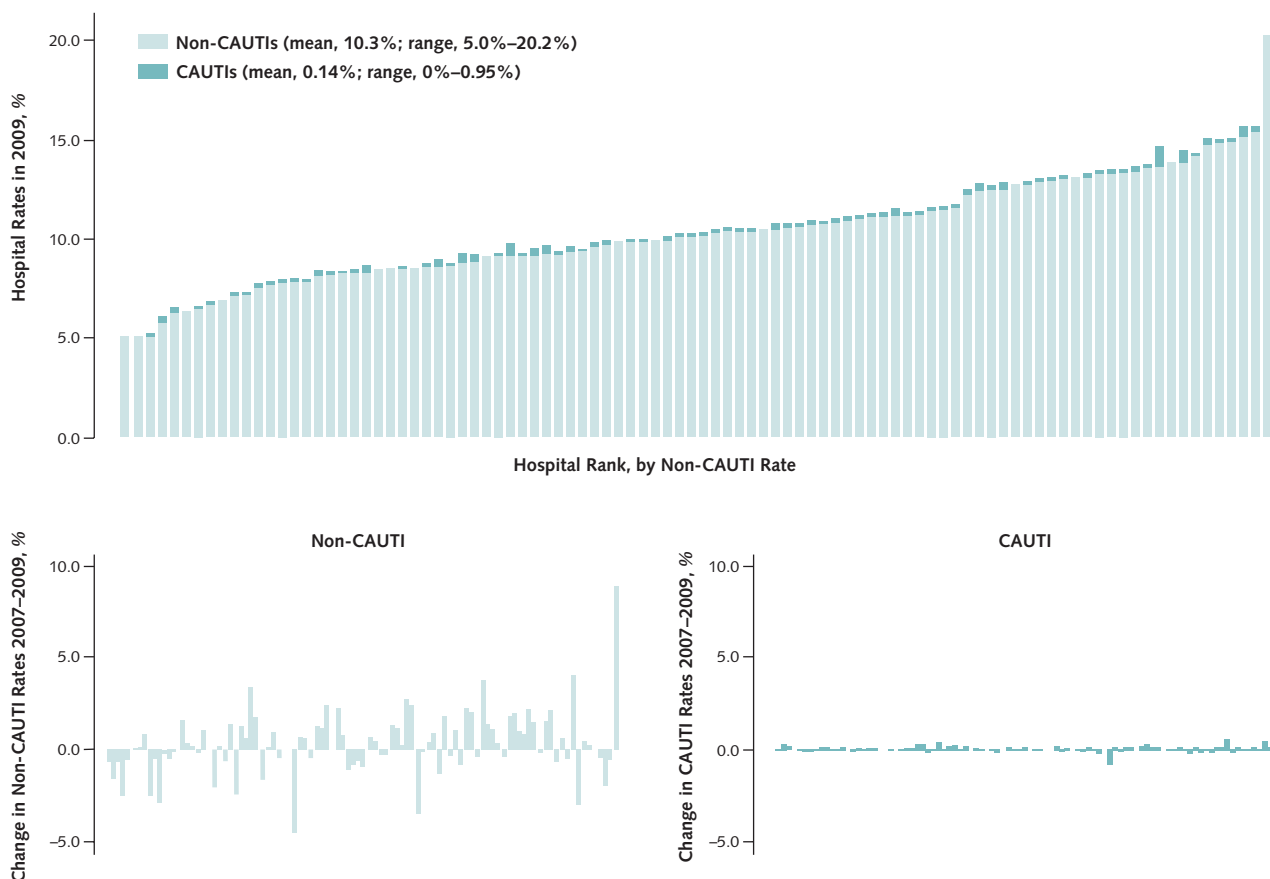
Effect of CAUTIs and UTIs on Hospital Payment

In 2009, 321 hospitalizations listed a CAUTI as hospital-acquired. Hospitals listed a mean of 18.7 secondary diagnoses for patients discharged with a hospital-acquired CAUTI (Table). Accounting for secondary diagnoses that generate higher payment, nonpayment for hospital-acquired CAUTI affected hospital payment (that is, reduced payment) for 25 of 781 343 (0.003%) hospitalizations. Twenty-two of these instances occurred in non-safety net hospitals (7.4% of 296 cases of hospital-acquired CAUTI) and 3 occurred in safety net hospitals (12.0% of 25 cases of hospital-acquired CAUTI).

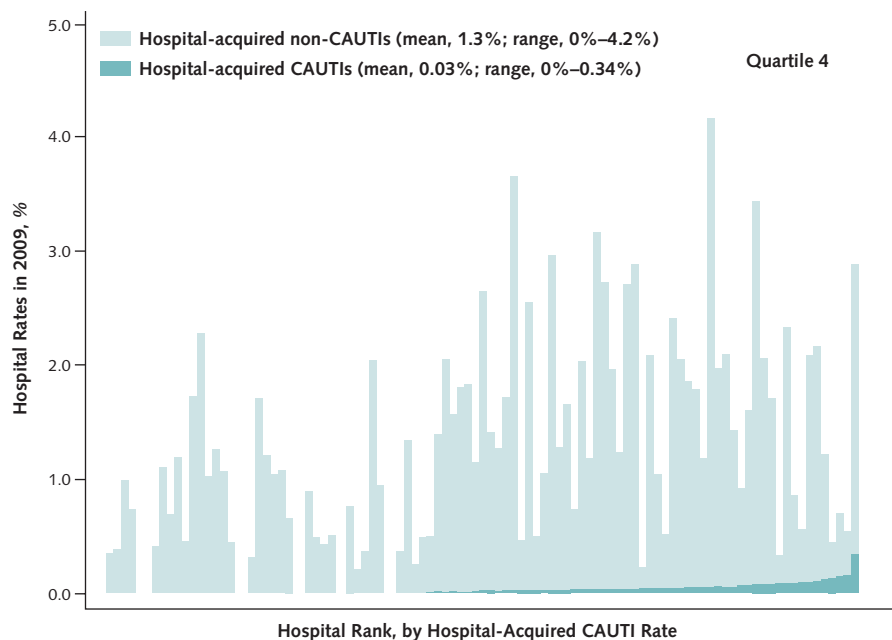
We estimated the dollar impact of nonpayment for these 25 hospitalizations with hospital-acquired CAUTI by using an average base Medicare payment of \$8700 that was in place at the University of Michigan in 2009. On the basis of these estimates, the hospital would have lost \$132 675 as a result of nonpayment of hospital-acquired CAUTI. This amount is 0.06% of annual payments (of the total \$215 000 000 paid by the Acute Inpatient Prospective Payment System). Because the base payment for the University of Michigan may be higher than most community hospitals, our estimates represent an upper limit of potential payment loss for hospital-acquired CAUTI events.

We also explored how often payment for any type of UTI as a secondary diagnosis affected hospital payment, given other patient comorbid conditions, by replacing all of the UTI diagnosis codes with a code that does not count as either a comorbid condition or a complication. In 2009, modification of the UTI secondary diagnosis codes to a nonpaying diagnosis code resulted in a lower-paying DRG for 7632 cases (9.1% of 84 290 UTIs and CAUTIs total

Figure 2. Rates of hospital-acquired non-CAUTIs and CAUTIs in 2009 and change in rates from 2007 to 2009.



A hospital's rate of diagnosis was calculated as the percentage of each hospital's discharges of adults with the indicated diagnosis. CAUTI = catheter-associated urinary tract infection.

Figure 3. Rates of hospital-acquired non-CAUTIs and CAUTIs in 2009.

A hospital's rate of diagnosis was calculated as the percentage of each hospital's discharges of adults with the indicated diagnosis. Thirty-nine hospitals reported 0 hospitalizations (all-payer) with hospital-acquired CAUTIs. CAUTI = catheter-associated urinary tract infection.

and 1% of all hospitalizations); 642 of these occurred in safety net hospitals (9.3% of 6937) and 6990 in non-safety net hospitals (9.0% of 77 353).

DISCUSSION

Hospital-acquired CAUTI was the first condition chosen for nonpayment because of its anticipated effect on large numbers of hospitalizations. Epidemiologic surveillance studies suggest that urinary tract sources are the most common of all nosocomial infections (20, 21), and medical record reviews demonstrate frequent urinary catheter use among Medicare patients (1). However, we showed that the current hospital discharge data set rarely identifies CAUTIs. The effect of a nonpayment policy based on these data is small. The accuracy of reporting from the data set is suspect. Moreover, we conclude that the current hospital discharge data set is not accurate or valid for comparing hospital-acquired CAUTI rates for the purpose of public reporting or imposing financial incentives or penalties.

Although diagnosis codes for UTIs are commonly listed as secondary diagnoses (approximately 10% of discharges), very few UTIs are identified in the claims data as CAUTIs by the addition of the 996.64 code. In contrast to epidemiologic studies reporting that most hospital-acquired UTIs are catheter-associated (22) (59% to 86% [8, 9, 23]), only 2.6% of all hospital-acquired UTIs were described in the claims data as catheter-associated. Rates of CAUTIs from claims data were also much lower than anticipated for Medicare patients who have high rates of uri-

nary catheter use during hospitalization (40%, according to the Medicare Patient Safety Monitoring System [1]). Catheter-associated UTIs are very common among catheterized patients. Studies show 3% to 10% risk for bacteriuria per day of catheterization (22, 24, 25) and that 9.9% of patients with indwelling catheters develop CAUTIs (8).

Medical record reviews and details of hospital coder instructions (12) help explain why so few UTIs are described as CAUTIs in administrative discharge claims data. Medical record reviews (4) have supported that a large proportion of UTIs (46%) are catheter-associated (including 35% of UTIs being hospital-acquired CAUTIs). Yet, urinary catheter use is often better documented in nursing notes, which, unlike physician notes, cannot be used by hospital coders to generate diagnoses for billing (12). For the hospital coder to identify the UTI as a CAUTI, it must be clearly identified as a CAUTI in the notes of a provider (for example, a physician, physician assistant, or nurse practitioner). If a hospital coder suspects that the UTI occurred after admission, the hospital coder must contact the provider for clarification of the status on admission if not clear from the provider's notes. Thus, it is not surprising that very few hospital-acquired CAUTI events are documented in the claims data used for triggering nonpayment and public reporting.

Another weakness of using claims data for public reporting is that billing coders are not trained or expected to collect and report diagnoses in the same manner as if they were generating a disease surveillance data set. They are

trained to code all diagnoses required for CMS reporting guidelines and are careful to report diagnoses that affect a patient's risk for mortality and severity of illness. Currently, there is no CMS reporting requirement for coders to list all hospital-acquired conditions in claims data. Because UTIs may not clearly affect a patient's mortality or severity of illness (particularly in comparison with other diagnoses), UTI diagnoses may not always be listed in claims data. Although several states have mandatory reporting requirements for certain hospital-acquired conditions, such as infections, this reporting is usually done in separate databases than the claims data set currently used for triggering nonpayment and public reporting.

The decrease in CAUTI events intended by the policy was not seen, comparing CAUTI events in Michigan from 2007 to 2009. In fact, a small but clinically insignificant increase in both non-CAUTIs and CAUTIs as secondary diagnoses occurred. Increases in non-CAUTI and CAUTI rates in the claims data set could be an unintended consequence of the nonpayment policy because hospitals have an incentive to document and describe all conditions that are present on admission to avoid potential nonpayment for this condition if described later in the hospitalization.

Financial impact for nonpayment of hospital-acquired CAUTI was limited. Even when we assessed a worst-case scenario of nonpayment for all UTI diagnoses, only 1% of all hospitalizations would have had reduced hospital payment. Although UTI is a common diagnosis, it is not a large target for financial savings by nonpayment because of the other comorbid conditions of patients with UTIs.

Our assessment of effect of nonpayment for hospital-acquired CAUTI is limited to analysis by claims data in Michigan in the first year after implementation of the Hospital-Acquired Conditions Initiative. We acknowledge that such policies can have important clinical effects not described in claims data, such as focusing hospitals' infection-prevention efforts on CAUTI prevention (26). Efforts to decrease inappropriate urinary catheter use can also decrease other non-infection-related risks, such as catheter-associated discomfort (27) and immobility risks (that is, thromboembolic disease and pressure ulcers [28]). It may also take more than 1 year to see an effect on CAUTI rates and coding practices about UTIs. To assess generalizability of CAUTI rates from Michigan claims data to other states (because of concerns that the Keystone CAUTI Bladder Bundle Initiative in Michigan could be responsible for low CAUTI rates in this state), we have studied the urinary catheter-association code use in claims data nationwide and found it to be similarly very low (4).

In conclusion, the financial impact of nonpayment for hospital-acquired CAUTI is low due to rare use of the catheter-association code and other comorbid conditions that generate similar payment. However, the most important finding of this study is that one of the most common nosocomial infections, hospital-acquired CAUTI, is only

rarely documented in the claims data set chosen for implementing nonpayment and public reporting of hospital-acquired conditions. In fact, using claims data for comparing hospitals has potential for unfair hospital penalty because hospitals with higher CAUTI rates in claims data may simply do a better job documenting catheter use and describing UTIs correctly as catheter-associated or hospital-acquired events in provider notes used by hospital coders to generate claims data. By 2015, rates of hospital-acquired events will be used to compare hospital performance nationwide to reduce payment for all Medicare hospitalizations for hospitals with risk-adjusted rates in the worst quartile of performance (29). Thus, the time has come to either improve the procedures for reporting hospital-acquired events in the claims data set to increase accuracy or abandon claims data for this purpose and change to data sets with more rigorous and standardized assessment about nosocomial events for comparing hospitals, such as surveillance data submitted to the National Healthcare Safety Network.

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Reproducible Research Statement: *Study protocol:* Available from Dr. Meddings (e-mail, meddings@umich.edu). *Data set:* Available by appli-

cation, purchase, and data use agreement from the Healthcare Cost and Utilization Project (www.hcup-us.ahrq.gov/databases.jsp). *Statistical code*: Not available.

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APPENDIX 1: HOW CODING HOSPITAL-ACQUIRED COMPLICATIONS AFFECTS HOSPITAL PAYMENT AND PUBLIC REPORTING

To illustrate how coding hospital-acquired complications affects hospital payment and public reporting (Hospital Compare), consider a patient hospitalized for pneumonia with comorbid heart failure who developed a hospital-acquired CAUTI during admission. In **Appendix Table 1**, we outline 5 potential ways this hospitalization could be described using diagnosis codes in the claims data used to obtain hospital payment and now also used to publicly report hospital rates of certain hospital-acquired conditions (such as hospital-acquired CAUTI) online by using Hospital Compare.

In scenario A, a diagnosis of pneumonia is listed, but no additional diagnoses are listed. The hospital receives payment for simple pneumonia and pleurisy without comorbid conditions or complications (DRG 195), and this record would not be recognized for having a case of hospital-acquired CAUTI for public reporting because neither the UTI code nor the catheter-association code was listed.

In scenarios B and C, the UTI code is listed as a secondary diagnosis without a catheter-association code. Regardless of whether the UTI is described as hospital-acquired (scenario B) or incorrectly as present on admission (scenario C), the UTI counts as a condition that leads to a higher-paying DRG (194: pneumo-

nia with comorbidity or complication), which yields more than \$2000 in additional hospital payment. There would also be no public reporting of a hospital-acquired condition from this hospitalization because the catheter-association code was not used.

In scenario D, because both the UTI and catheter-association codes are listed and described as hospital-acquired, the coding criteria have been met for describing a hospital-acquired CAUTI. Therefore, neither code counts toward a higher-paying DRG; thus, the hospital receives the same payment as though 0 secondary diagnoses were listed. Also, this record would be recognized as containing a hospital-acquired condition for public reporting.

Yet, in scenario E, in addition to listing both the hospital-acquired UTI and catheter-association codes, the hospital coder described the patient's comorbid heart failure with an additional secondary diagnosis code. Therefore, although the UTI and catheter-association codes were recognized as complications and did not count as payment-increasing comorbid conditions (and were recognized as complications for public reporting), the heart failure code counts toward the higher-paying DRG, yielding higher hospital payment.

APPENDIX 2: DO THE FIRST 8 SECONDARY DIAGNOSES CAPTURE MOST OF THE HOSPITAL-ACQUIRED CAUTI EVENTS?

Current public reporting of hospital-acquired CAUTI rates for U.S. hospitals on Hospital Compare uses data only from the first 8 secondary diagnoses that are submitted to the CMS for payment. This practice is anticipated to be expanded in 2012 (30) to include data from 25 secondary diagnoses. To assess the difference of using only the first 8 compared with all secondary diagnoses for identifying hospital-acquired CAUTI events, we compared hospital-acquired CAUTI events using the first 8 secondary diagnoses versus from all 29 secondary diagnoses for Michigan hospitalizations. Although hospital-acquired CAUTI events were rarely coded in either the first 8 or all 29 secondary diagnoses, the first 8 secondary diagnoses captured only 180 (56.1%) of all (321 total) hospital-acquired CAUTI events in Michigan in 2009 for an all-payer population and only 118 (54.9%) hospital-acquired CAUTI events for Medicare patients (**Appendix Table 4**).

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Appendix Table 1. How Coding of Hospital-Acquired Complications Affects Hospital Payment and Public Reporting

Coding Scenario	Secondary Diagnosis ICD-9-CM Codes Listed in Discharge Claims Data*	Status of Diagnosis at Admission†	Hospital Payment‡	Would a Hospital-Acquired Complication Be Publicly Reported From This Record?
A	No secondary diagnoses listed	NA	\$6365	No
B	Urinary tract infection (599.0)	Hospital-acquired	\$8749	No
C	Urinary tract infection (599.0)	POA	\$8749	No
D	Urinary tract infection (599.0)	Hospital-acquired	\$6365	Yes
E	Infection and inflammatory reaction due to indwelling urinary catheter (996.64)	Hospital-acquired	\$8749	Yes
	Urinary tract infection (599.0)	Hospital-acquired		
	Infection and inflammatory reaction due to indwelling urinary catheter (996.64)	Hospital-acquired		
	Systolic heart failure (428.22)	POA		

ICD-9-CM = International Classification of Diseases, Ninth Revision, Clinical Modification; NA = not applicable; POA = present-on-admission.

* In addition to principal diagnosis 481: pneumococcal pneumonia.

† As coded with POA indicator variable.

‡ Payments are calculated by assuming a base rate of \$8700, which is the base rate for admissions with a cost weight of 1.0 to the University of Michigan in 2009.

Appendix Table 2. ICD-9-CM Diagnosis Codes Used to Identify Urinary Tract Infections*

Code	Description
112.2	Candidiasis of other urogenital sites
590.10	Acute pyelonephritis, without lesion of renal medullary necrosis
590.11	Acute pyelonephritis, with lesion of renal medullary necrosis
590.2	Renal and perinephric abscess
590.3	Pyeloureteritis cystica
590.80	Pyelonephritis, unspecified
590.81	Pyelitis or pyelonephritis in diseases classified elsewhere
595.0	Acute cystitis
597.0	Urethral abscess
599.0	UTI, site not specified

ICD-9-CM = International Classification of Diseases, Ninth Revision, Clinical Modification; UTI = urinary tract infection.

* The ICD-9-CM diagnosis codes listed are used for identification of UTIs for nonpayment in accordance with the Hospital-Acquired Conditions Initiative (1–3), when combined with the catheter-association code 996.64 and listed as not present on admission. Cases of catheter-associated UTI as the primary reason for admission were identified by having the catheter code (ICD-9-CM code 996.64) listed as the first diagnosis or having a UTI code listed as the first diagnosis and a catheter code listed among the secondary diagnoses. Cases of UTI as a secondary diagnosis (meaning that they were not the primary reason for admission) were identified with a secondary diagnosis UTI code without the catheter code. Secondary diagnosis catheter-associated UTIs were identified by the catheter code without a UTI ICD-9-CM code as principal diagnosis.

Appendix Table 3. Use of POA Indicator to Identify HACs*

POA Indicator Coding	Meaning of This Code	Payment Decision by CMS for Conditions Listed With This POA Status
Y	Diagnosis was present at time of inpatient admission.	CMS will pay the CC/MCC DRG for those selected HACs that are coded as Y for the POA indicator.
W	Clinically undetermined. Provider unable to clinically determine whether the condition was present at the time of inpatient admission.	CMS will pay the CC/MCC DRG for those selected HACs that are coded as W for the POA indicator.
N	Diagnosis was not present at time of inpatient admission.	CMS will not pay the CC/MCC DRG for those selected HACs that are coded as N for the POA indicator.
U	Documentation insufficient to determine whether the condition was present at the time of inpatient admission.	CMS will not pay the CC/MCC DRG for those selected HACs that are coded as U for the POA indicator.
1	This is listed for certain diagnoses for which hospitals are not required to list the POA status.	Exempt from POA reporting, does not alter Medicare payment.

CC = complication or comorbidity; CMS = Centers for Medicare & Medicaid Services; DRG = diagnosis-related group; HAC = hospital-acquired condition; MCC = major complication or comorbidity; POA = present-on-admission.

* Details about POA coding transitions and edits, such as how exempt coding was handled each year for Michigan, were accounted for during the analysis. Invalid coding for UTIs included missing, exempt, and any other coded value beyond the accepted valid codes of N, Y, W, or U.

Appendix Table 4. Do the First 8 Secondary Diagnoses Capture Most of the Hospital-Acquired CAUTI Events?

Michigan Hospitalizations in 2009 With a Hospital-Acquired CAUTI*	First 8 Secondary Diagnoses (Diagnoses 2–9)	All Secondary Diagnoses (Diagnoses 2–30)
All-payer hospitalizations, <i>n</i> (%)	180 (56.1)	321 (100.0)
Medicare hospitalizations, <i>n</i> (%)†	118 (54.9)	215 (100.0)

CAUTI = catheter-associated urinary tract infection.

* Data are from the 2009 Michigan Healthcare Cost and Utilization Project State Inpatient Database (11).

† Medicare is the primary or secondary payer.

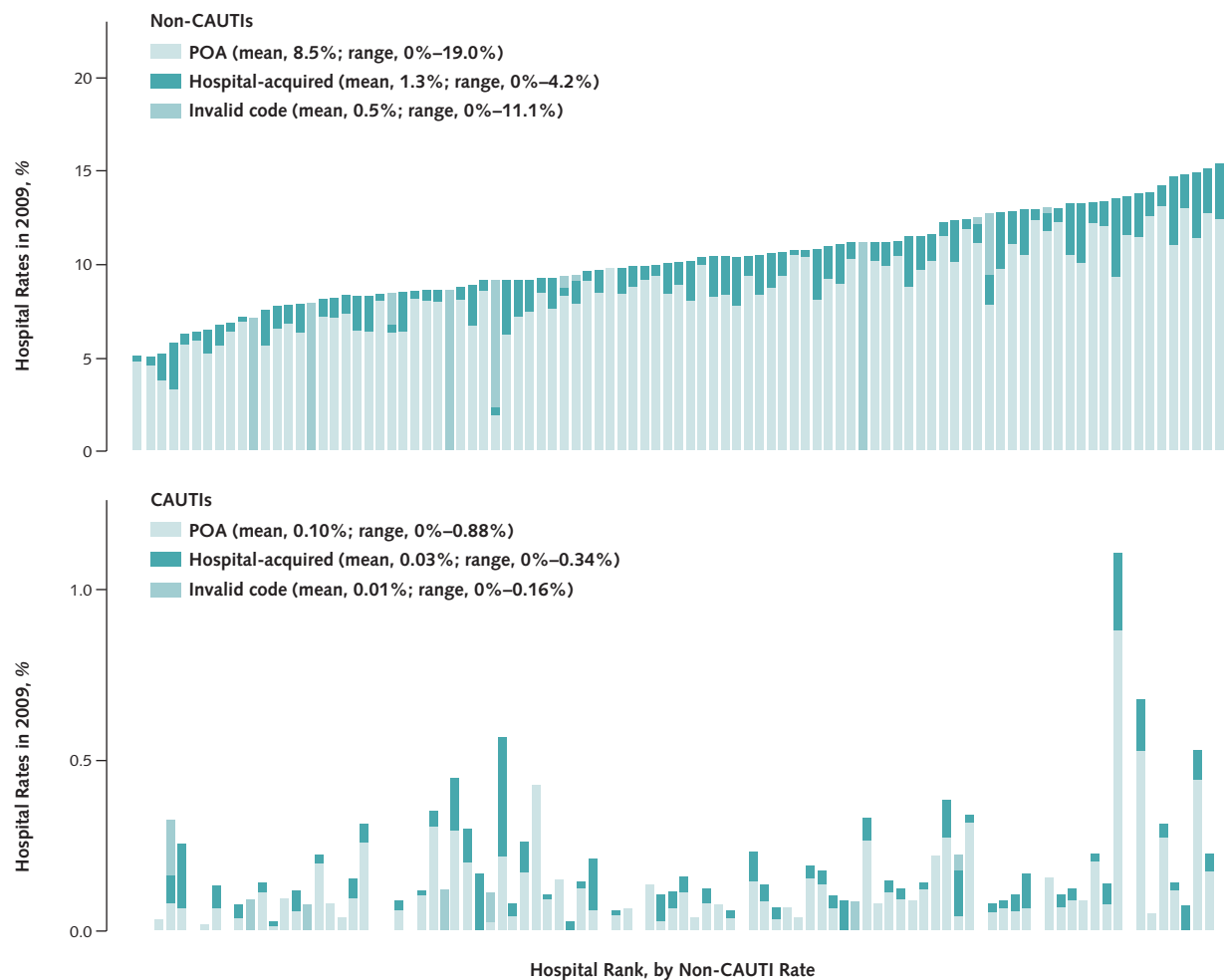
Appendix Table 5. 2009 Hospital Rates of UTI for Safety Net Hospitals Versus Non-Safety Net Hospitals, by Category*

UTI Category	Hospitals, <i>n</i> (%)	Hospitalizations, <i>n</i> (%)	UTI Cases, <i>n</i> (%)	Mean Hospitalization Rate, % (95% CI)
Safety net hospitals	11 (11.5)	68 182 (8.7)		
Non-CAUTIs			6848 (10.0)	9.4 (7.6–11.1)
CAUTIs			89 (0.10)	0.10 (0.03–0.17)
Hospital-acquired non-CAUTIs			878 (1.3)	0.9 (0.5–1.4)
Hospital-acquired CAUTIs			25 (0.04)	0.02 (0.001–0.05)
Non-safety net hospitals	85 (88.5)	713 161 (91.3)		
Non-CAUTIs			76 147 (10.7)	10.5 (9.9–11.0)
CAUTIs			1206 (0.2)	0.15 (0.11–0.18)
Hospital-acquired non-CAUTIs			12 643 (1.8)	1.4 (1.2–1.6)
Hospital-acquired CAUTIs			296 (0.04)	0.04 (0.03–0.05)

CAUTI = catheter-associated urinary tract infection; UTI = urinary tract infection.

* Data are from the 2009 Michigan Healthcare Cost and Utilization Project State Inpatient Database (11).

Appendix Figure. Rates of non-CAUTIs and CAUTIs as hospital-acquired and POA events in 2009.



A hospital's rate of diagnosis was calculated as the percentage of each hospital's discharges of adults with the indicated diagnosis. Four Michigan hospitals listed invalid POA codes for all diagnoses and all hospitalizations in the 2009 Healthcare Cost and Utilization Project State Inpatient Database. Because an invalid POA code generates an error, invalid codes would be corrected by hospitals before final submission to payers. CAUTI = catheter-associated urinary tract infection; POA = present-on-admission.