

Using Medicare Claims to Identify U.S. Hospitals with a High Rate of Surgical Site Infection Following Hip Arthroplasty

Michael S. Calderwood, MD, MPH^{1,2}; Ken Kleinman, ScD¹; Dale W. Bratzler, DO, MPH^{3,4}; Allen Ma, PhD³; Christina B. Bruce¹; Rebecca E. Kaganov¹; Claire Canning, MA¹; Richard Platt, MD, MSc¹; Susan S. Huang, MD, MPH⁵; for the CDC Prevention Epicenters Program and the Oklahoma Foundation for Medical Quality.

1. Harvard Medical School and Harvard Pilgrim Health Care Institute, Boston, MA; 2. Brigham and Women's Hospital, Boston, MA; 3. Oklahoma Foundation for Medical Quality, Oklahoma City, OK; 4. University of Oklahoma Health Sciences Center, College of Public Health, Oklahoma City, OK; 5. University of California Irvine School of Medicine, Irvine, CA.

Contact:

Michael S. Calderwood, MD, MPH
Division of Infectious Diseases
Brigham and Women's Hospital
15 Francis Street, PBB-A4
Boston, MA 02115

Email: mcalderwood@partners.org
Phone: 617-525-3236

BACKGROUND
<ul style="list-style-type: none"> Hip Arthroplasty in the U.S. <ul style="list-style-type: none"> Approximately 390,000 primary hip arthroplasty procedures per year¹ \$500 million in potentially preventable health care costs attributable to SSI following hip arthroplasty² National Focus on SSIs <ul style="list-style-type: none"> 2nd most common hospital-acquired infection Target for public reporting (state and national)³ Target for value-based purchasing ("pay for performance")⁴ Limitations to SSI Benchmarking <ul style="list-style-type: none"> Variable hospital surveillance, especially for post-discharge events which account for the majority of SSIs^{5,6} CDC/NHSN SSI definitions include subjective criteria such as "diagnosis of [SSI] by surgeon"⁷ Case mix adjustment limited to a relatively small number of data elements Improving SSI Surveillance <ul style="list-style-type: none"> Payer-based claims contain diagnosis and procedure codes indicating care provided to patients These claims capture data regardless of where care is sought Claims also contain comorbidity data that can be used for risk-adjustment In a pilot study, claims-based surveillance performed favorably when compared with traditional surveillance⁸
METHODS
<ul style="list-style-type: none"> Study Design <ul style="list-style-type: none"> Retrospective cohort study Inclusion criteria: Medicare recipients age 65 and older (excluding Medicare Advantage) who underwent total or partial hip arthroplasty (ICD-9 code 81.51 or 81.52) between 1/1/2005 and 12/31/2007 Exclusion criteria: 1. Another major procedure within prior 60 days, 2. Claims code(s) suggestive of SSI within prior 30 days, 3. Multiple surgery dates for the same procedure Codes indicating SSI (see handout): 38 ICD-9 Diagnosis Codes, 5 ICD-9 Procedure Codes, and 18 CPT Procedure Codes found in Medicare Part A (inpatient, outpatient) and Medicare Part B (physician claims) within 365 days post-implant Ranking of U.S. Hospitals <ul style="list-style-type: none"> Generalized linear mixed model used to produce a risk-adjusted ranking of U.S. hospitals Risk-adjusted for individuals' age, gender, and comorbidities (components of revised Romano score)^{9,10} Hospitals ranked based on empirical Bayes estimators to account for stability of estimates related to hospital procedure volume

METHODS
<ul style="list-style-type: none"> Clinical Chart Review <ul style="list-style-type: none"> Randomly selected 500 flagged patients from both best decile and worst decile hospitals Requested all inpatient and outpatient records flagged by a code suggestive of SSI Charts were reviewed to determine if CDC/NHSN SSI criteria were met Analysis <ul style="list-style-type: none"> Confirmed SSI: Patient selected for review with chart-confirmation of SSI No Confirmed SSI: 1. Patient selected for review with no chart confirmation of SSI (including patient with non-received or insufficient medical records), 2. Proportional sample of same decile patients randomly drawn from patients with no SSI code Logistic regression for outcome of chart-confirmed SSI <ul style="list-style-type: none"> Primary Predictor: Whether surgery was performed in worst versus best-decile hospital Other Covariates: Age, Gender, Comorbidities (components of revised Romano score)
RESULTS
<p>National Eligible Study Population (2005-2007) N = 524,892 patients from 3,296 U.S. hospitals</p> <p>329 Hospitals in Best-Performing Decile: 90,972 hip arthroplasties performed, 3,899 (4.3%) with ≥1 SSI Code</p> <p>329 Hospitals in Worst-Performing Decile: 52,082 hip arthroplasties performed, 7,745 (14.9%) with ≥1 SSI Code</p> <p>Chart Requests</p> <p>Best-Performing Decile: Requested records on 473 out of 3,899 patients (12.1%) with ≥1 SSI Code</p> <p>Worst-Performing Decile: Requested records on 469 out of 7,745 patients (6.1%) with ≥1 SSI Code</p> <p>Selection of Non-Flagged Patients to Include in Analysis</p> <p>Best-Performing Decile: Included 10,536 out of 87,073 patients (12.1%)</p> <p>Worst-Performing Decile: Included 2,705 out of 44,337 patients (6.1%)</p>

RESULTS
<p>SSI confirmation in flagged patients for whom medical records were requested and received:</p> <ul style="list-style-type: none"> Confirmation rates in the two deciles were similar (135/348, 39% in best-decile hospitals vs. 116/280, 41% in worst decile hospitals, p = NS). This means that an SSI was identified for every ~2.5 patients reviewed on the basis of a claim code suggestive of SSI. Of the 251 confirmed SSIs, 244 (97%) were diagnosed after initial discharge. Among patients who developed an SSI post-discharge, only 74% were readmitted to the hospital where the hip arthroplasty was performed. <p>SSI Rates in Best versus Worst-Decile Hospitals:</p> <p>After risk adjustment, patients in worst-decile hospitals had a 3-fold higher odds of developing an SSI compared with those in best-decile hospitals (Odds Ratio: 2.9, 95% CI: 2.2-3.7, p-value < 0.0001).</p> <p>(The result was similar when limited to deep incisional and organ/space SSI [Odds Ratio: 3.0, 95% CI: 2.2-4.1, p-value < 0.0001]).</p>
CONCLUSIONS
<ol style="list-style-type: none"> Medicare claims successfully identified groups of hospitals with high and low aggregate SSI risk. This methodology can be implemented by hospitals for more comprehensive and efficient SSI detection. In addition, this methodology can be used both for validation assessments of mandated reporting and to identify hospitals that merit further evaluation aimed at improving surgical care.