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National Incidence of Patient Safety Indicators in the Total Hip Arthroplasty Population

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ABSTRACT

Background: The Centers for Medicare & Medicaid Services use the incidence of patient safety indicators (PSIs) to determine health care value and hospital reimbursement. The national incidence of PSI has not been quantified in the total hip arthroplasty (THA) population, and it is unknown if patient insurance status is associated with PSI incidence after THA.

Methods: All patients in the Nationwide Inpatient Sample (NIS) who underwent THA in 2013 were identified using the *International Classification of Diseases, Ninth Revision, Clinical Modification* codes. The incidence of PSI was determined using the *International Classification of Diseases, Ninth Revision*, diagnosis code algorithms published by the Centers for Medicare & Medicaid Services and the Agency for Healthcare Research and Quality. The association of insurance status and the incidence of PSI during the inpatient episode was determined by comparing privately insured and Medicare patients with Medicaid/self-pay patients using a logistic regression model that controlled for patient demographics, patient comorbidities, and hospital characteristics.

Results: In 2013, the NIS included 68,644 hospitalizations with primary THA performed during the inpatient episode. During this period, 429 surgically relevant PSI were recorded in the NIS. The estimated national incidence rate of PSI after primary THA was 0.63%. In our secondary analysis, the privately insured cohort had significantly lower odds of experiencing one or more PSIs relative to the Medicaid/self-pay cohort (odds ratio, 0.47; 95% confidence interval, 0.29–0.76).

Conclusion: The national incidence of PSI among THA patients is relatively low. However, primary insurance status is associated with the incidence of one or more PSIs after THA. As value-based payment becomes more widely adopted in the United States, quality benchmarks and penalty thresholds need to account for these differences in risk-adjustment models to promote and maintain access to care in the underinsured population.

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As the population in the United States continues to age, the incidence and prevalence of total hip arthroplasty (THA) is expected to increase substantially [1,2]. The increase in THA incidence and prevalence comes as the US health care system

continues to transition toward tying reimbursement to health care quality and patient safety. The Hospital Value-Based Purchasing Program and the Hospital-Acquired Condition (HAC) Reduction Program are 2 initiatives created by the Centers for Medicare & Medicaid Services (CMS) designed to connect health care reimbursement to health care quality and patient safety [3].

These 2 programs allow CMS to withhold Medicare reimbursements to incentivize hospitals to improve health care quality. The HAC Reduction Program determines health care quality in part by determining the annual incidence of patient safety indicators (PSIs) developed by the Agency for Healthcare Research and Quality (AHRQ) [4,5]. PSIs are used to calculate rates of adverse health care quality events such as postoperative hematoma, deep

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vein thrombosis (DVT), and pressure ulcer at the provider, hospital, and regional health care market levels [4]. Hospitals that perform poorly according to PSI incidence risk losing 1% of all Medicare reimbursements [3].

Although the annual incidence of THA is estimated to increase to 587,000 by 2021, the national incidence of PSI is unknown in this population [6]. Quantifying the incidence rate of PSI will serve as a benchmark against which future progress can be measured. In addition, prior studies adjusted for patient-level covariates show that relative to privately insured patients, Medicaid patients face longer delays to surgery [7], are more likely to require readmission within 30 days after THA [8], and are at a higher risk of requiring early revision hip arthroplasty relative to commercially insured patients [9]. It is currently unknown if patient insurance status should be included in risk adjustment models when projecting PSI incidence as part of value-based purchasing and HAC Reduction Programs.

The present study uses a nationally representative, all-payer database to (1) determine the national incidence of PSI among THA patients and (2) quantify the association between insurance status and PSI among patients undergoing THA. This study focuses on PSI incidence among THA patients, and based on the results of prior studies [10–13], we hypothesize that insurance status is significantly associated with the odds of experiencing a PSI after THA.

Methods

Overview and Study Design

The primary aim of this study was to quantify the incidence of adverse patient safety events based on PSI among THA patients using a nationally representative, all-payer database. The secondary aim was to determine if insurance status is associated with PSI incidence after THA. Both analyses used a retrospective cohort design and included THA patients from 2013. This study obtained institutional review board approval before study initiation (#EM-14-30).

Participants/Study Subjects

In the primary analysis, we queried Nationwide Inpatient Sample (NIS) data to determine the total number of primary THAs in 2013. The year 2013 was chosen because it was the most recent year of available data. Patients undergoing THA were identified using the *International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM)* procedure code 81.51 [1,14,15]. In this primary analysis, all patients aged ≥ 18 years who underwent primary THA in 2013 were included to determine the national incidence of PSI in this population.

In the secondary analysis, we analyzed significant associations between patient-level variables and the risk of experiencing at least one PSI after THA. We specifically focused on comparing patients with private insurance with patients with Medicaid/self-pay to determine the association between primary insurance status and PSI incidence. We also compared Medicare patients with Medicaid/self-pay patients. Patients with a primary payer status of “missing” or “other” were excluded from this secondary analysis.

Variables, Outcome Measures, Data Source, and Bias

The present study used data from the NIS collected from 2013. As the largest inpatient database in the United States, the NIS is collected annually and is a 20% stratified sample of all hospital discharges in the United States. Individual entries in the NIS represent a single inpatient episode and do not extend to the

postdischarge period. Hospitals contribute administrative data to the NIS that include the *ICD-9-CM* diagnosis and procedure codes attributable to each patient discharge at that hospital in a given year. We obtained data from the NIS on patient-level demographics, comorbidities, diagnoses, procedure performed, length of stay, hospital charges, inhospital mortality, and hospital characteristics (eg, hospital size, geographic location, and hospital teaching status) [16]. The NIS has a complex survey design, and sampling weights are provided with the NIS to enable calculation of national estimates.

In addition, the NIS includes Elixhauser comorbidity data. The Elixhauser comorbidity index is composed of 30 specific comorbidities shown to have a strong association with inhospital mortality. Of the 30 comorbidities originally described by Elixhauser et al [3], the NIS includes 29 of the original 30 Elixhauser comorbidities.

Outcome of Interest

In both the primary and secondary analyses, the primary outcome variable of interest was the occurrence of a PSI during an inpatient episode after THA. The AHRQ and CMS publish a list of *ICD-9-CM* codes that can be used to determine if a patient experienced a PSI during an inpatient episode. Therefore, in the present study, patients were categorized as experiencing a surgically relevant PSI if their NIS record included a specific list of *ICD-9-CM* codes published by the AHRQ and CMS [17,18]. The AHRQ and CMS regularly update the specific *ICD-9-CM* codes that constitute surgically relevant PSI. In the present study, the *ICD-9-CM* codes were used rather than the *ICD-10-CM* codes because the most recently available data were from 2013, before *ICD-10-CM* codes were used in the United States. Specifically, the list of surgically relevant PSIs measured by the AHRQ and CMS include codes for pressure ulcer, iatrogenic pneumothorax, central venous catheter-related blood infection, postoperative hip fracture, perioperative hemorrhage or hematoma, postoperative metabolic derangement, postoperative respiratory failure, postoperative pulmonary embolism or DVT, postoperative sepsis, postoperative wound dehiscence, and accidental puncture or laceration. These surgically relevant PSI are combined to create a single PSI variable, termed PSI 90 by the AHRQ. The incidence of PSI 90 can be interpreted as the incidence of one or more of the surgically relevant PSI during an inpatient episode. Although the validity of using these specific PSIs to measure adverse events after THA may be unclear, CMS uses this PSI 90 composite measure in value-based purchasing programs.

In our secondary analysis, insurance status was the independent variable of interest (specifically privately insured relative to Medicaid/self-pay) and the incidence of one or more PSIs was the outcome of interest. In the United States, Medicare is a federal health insurance program for people aged ≥ 65 years and other, younger patients with disabilities [19]. Similarly, Medicaid is a social health insurance program for families and individuals with limited resources. Therefore, Medicaid is frequently used as a marker for low socioeconomic status. In our secondary analysis, we focused on the comparison between privately insured patients and Medicaid/self-pay (ie, uninsured) patients because significant differences likely exist in the extent and quality of health care available to the privately insured and Medicaid/self-pay populations. We felt that the privately insured and Medicaid/self-pay cohorts represented the 2 extremes of insurance coverage in the United States and would therefore yield a clearer answer as to the potential association between insurance status and odds of experiencing one or more PSIs after THA.

In this analysis, we included a series of potential confounders including demographic data (patient age, gender, race [black,

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