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Appendix

The National Inpatient Sample (NIS) is a nationally representative sample that can be used to provide estimates of all inpatient discharges in the United States (US). The NIS, developed and sponsored by the Agency for Healthcare Research and Quality (AHRQ), is the largest publicly available all-payer inpatient healthcare database designed to produce U.S. regional and national estimates of inpatient utilization. It is a 20% representative sample of all inpatient stays occurring in the United States and contains data on about 7 million patients annually that can be weighted to estimate the more than 35 million hospitalizations occurring each year. The NIS has been used extensively in surgical epidemiologic research and represents the most accurate way to estimate the national incidence and prevalence of shoulder arthroplasty in the United States if used properly.[51-55] Furthermore, it been used in multiple studies to estimate yearly incidence of shoulder, hip, and knee arthroplasty in the US,[5,9,12,17,56-59] as well as estimated hip and knee arthroplasty prevalence.[13]

Epidemiologic parameters for this study were defined as follows: *prevalence*- the number of individuals alive on a certain date with a shoulder arthroplasty procedure performed at some point in their lifetime; *incidence* is the number of shoulder arthroplasty procedures performed each year per 100,000 people; and *procedural volume* is the raw number of shoulder arthroplasties performed each year.

The NIS was queried from 1988, the first year of data available from the NIS, through 2017, the most recent year data was available, to obtain the yearly incidence and procedural volume of shoulder arthroplasty performed in the United States. Patients were identified using international classification of diseases (ICD) 9th and 10th revision procedure codes. From 1988 to 2010, the ICD-9 code for TSA (aTSa and rTSA, 81.80) and hemiarthroplasty (HA) (81.81) was utilized. After Oct. 1, 2010, the ICD-9 code for rTSA (81.88) was utilized and grouped with aTSA. For revision shoulder arthroplasty, the ICD-9 codes 81.97 and 80.01 (revision of joint replacement of upper extremity and arthrotomy for removal of shoulder prosthesis without replacement) were used. ICD-10 procedure codes were utilized after October 1st, 2015, when the transition from ICD-9 to ICD-10 took place. From 2009 to October 2015, the ICD-9 code 81.97 included both revision total elbow arthroplasty (TEA) and TSA. From October 2015 through 2017, these procedures could be separated with ICD-10 codes, and only TSA was reported. We chose not to adjust the procedural incidence of revision TSA from 2002-2015, as the volume of revision TEA represented only 350 (95% Confidence Interval [CI]: 253-447) procedures in 2016 and 355 (95% CI: 246-464) procedures in 2017, and thus likely made up a small fraction of the ICD-9 code 81.97. Patient information including age, sex, and US census region of hospital were also recorded.

Population data was obtained from the United States Census Bureau.[60] Population data was obtained specific to calendar year, sex, age, and US census region. Actuarial life tables were obtained from the Centers for Disease Control (CDC), National Center for Health Statistics (NCHS) vital statistics.[14] While the effect of shoulder arthroplasty on mortality is not fully elucidated, one study found that patients with any shoulder arthroplasty procedure performed did not have a different risk of mortality compared to a reference group.[44, 45] As such, we elected not to deflate or inflate our estimates, as there are different mortality estimates depending on diagnosis type, which could not be reliably assessed.

Cost for revision arthroplasty was calculated by multiplying patient total charges by hospital-specific cost-to-charge ratios (CCR) and was adjusted for inflation using the consumer price index.[61] Costs reflect the actual expenses incurred in the delivery of hospital services, such as wages,

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supplies, and utility costs.[62] 95% confidence intervals (CI) around prevalence, procedural volume estimate, and cost estimates were created with the complex samples function of SPSS.

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