

## Relationship of osteoarthritis-related total shoulder arthroplasty risk with osteoarthritis-related hip and knee arthroplasty risk

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**INTRODUCTION:** Glenohumeral osteoarthritis (OA) causes severe pain akin to hip and knee OA, and US rates of total shoulder arthroplasty (TSA) procedures to treat end-stage glenohumeral OA have increased over time in recent years. Studies have shown that OA-related TSA is highly correlated with undergoing hip and knee arthroplasty (THA/TKA), but the absolute risk of OA-related TSA following arthroplasty for OA at the hip/knee is not well-defined. We aimed to evaluate the risk of OA-related TSA following an initial (index) OA-related THA or TKA procedure, as well as the risk of OA-related THA or TKA following an index OA-related TSA procedure in the Healthcare Cost and Utilization Project (HCUP database).

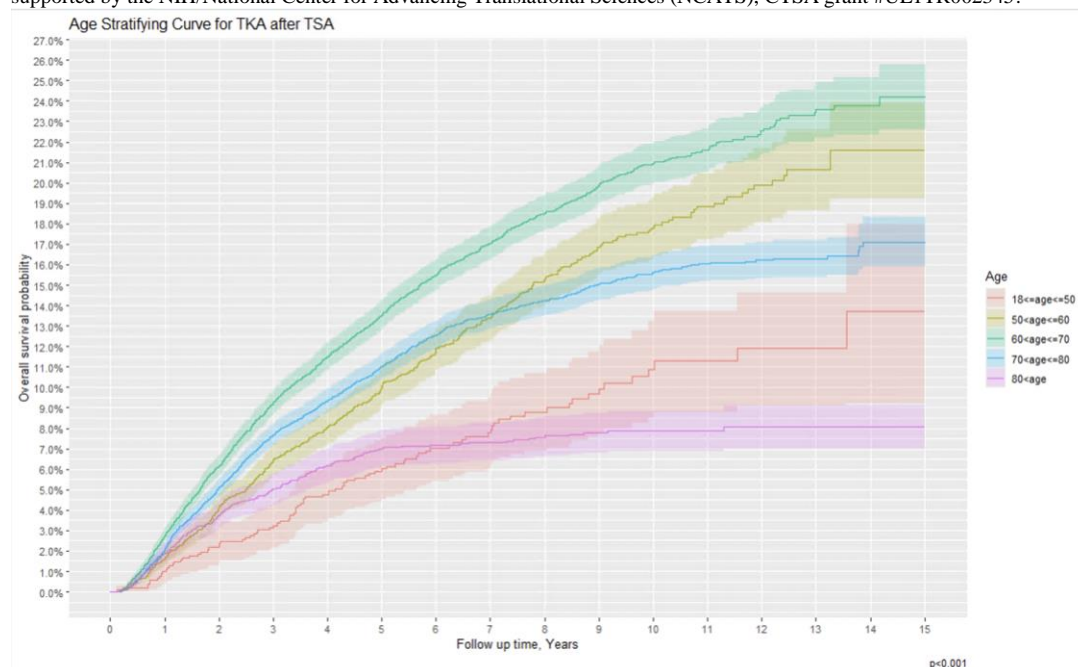
**METHODS:** We used HCUP National Inpatient Sample data from New York (2005-2018), Florida (2005-2019) and Massachusetts (2010-2019), where patient hospitalizations can be tracked longitudinally. These datasets include 108,808 TSA, 669,006 THA and 1,085,780 TKA procedures. Analyses were limited to procedures that occurred alongside a primary diagnosis of OA. Descriptive analyses were conducted characterizing THA, TKA, and TSA cases. TSA risk was evaluated separately by type of index arthroplasty procedure (TKA or THA patients). THA risk and TKA risk was evaluated in patients whose index procedure was TSA. Cox proportional hazards regression models were used to determine predictors of risk for subsequent arthroplasty, including age, sex, insurance status, race, and calendar year of index procedure. Kaplan-meier curves were used to show total and stratified arthroplasty risk estimates across time from index arthroplasty, including calculation of 5-year and 10-year risk estimates. For index THA/TKA patients, we further evaluated the associations between multiple procedures and TSA risk, considering combinations of non-shoulder arthroplasty procedures as a time-varying exposure.

**RESULTS:** Among 317,278 index THA patients, there were 6,251 TSAs over a median 8-year follow-up, while among 590,113 index TKA patients, there were 13,679 TSAs over with a median 8.5 years follow-up. Among index THA patients, the 5-year risk of TSA was 1.2% (95%CI=1.1-1.2%) and the 10-year risk of TSA was 2.4% (2.3-2.4%). In patients who had a subsequent TKA procedure, TSA risk was 179% higher (absolute 10-year TSA risk=4.9%, 95%CI=4.5-5.2%) compared to those with only a history of THA. Among index TKA patients, the 5-year risk of TSA was 1.2% (95%CI=1.2-1.3%) and the 10-year risk of TSA was 2.7% (2.6-2.7%). In patients who had a subsequent THA procedure, TSA risk was 128% higher (absolute 10-year TSA risk=5.1%, 95%CI=4.8-5.5%) compared to those with only a history of TKA. For both THA and TKA patients, risk of TSA was higher for women, patients aged 60-69, Medicare patients, and patients with index procedures done in later calendar years (all independent predictors of TSA risk with P<0.001 when considered together in a Cox regression model). Among the 27,684 index TSA patients, there were 3,917 subsequent TKA procedures and a 10-year TKA risk of 17% (16-17%). In these same patients, there were 2,105 subsequent THA procedures and a 10-year THA risk of 9.2% (8.8-9.6%). Risk was significantly higher in specific patient subgroups. For instance, index TSA patients aged 60-69 had a 21% risk of TKA (Figure 1) and 11% risk of THA at 10 years.

**DISCUSSION:** Risk of subsequent arthroplasty is high after an index arthroplasty procedure and influenced by OA risk factors (age, sex), as well as factors that influence healthcare access (insurance status) and that may reflect practice patterns (calendar year). Prior studies have indicated that patients with index TSA have a particularly high risk of subsequent arthroplasty. Our study shows that this corresponds to a nearly 1 in 5 risk of TKA within 10 years and nearly 1 in 10 risk of THA within 10 years, with even higher risk in some patient subsets.

**SIGNIFICANCE/CLINICAL RELEVANCE:** These findings offer a better understanding of how TSA risk corresponds with risk of other joint arthroplasty procedures and could improve patient counseling. By identifying high-risk patient groups, our findings can contribute to early osteoarthritis evaluation and improved risk assessment for subsequent arthroplasty procedures.

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**Figure 1: Age-stratified risk of TKA across time following index TSA in the New York, Florida, and Massachusetts HCUP database**