

Surgeon Volume and Periprosthetic Joint Infection following Total Joint Arthroplasty: An Analysis of 6,761 Surgeons in the United States

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INTRODUCTION:

Periprosthetic joint infection (PJI) is a devastating complication following total knee (TKA) and total hip arthroplasty (THA). Increasing surgeon volume may correlate with decreased risk of PJI following total joint arthroplasty (TJA). This study aimed to identify an annual surgeon volume threshold at which patients are less likely to experience postoperative PJI and evaluate differences in outcomes of patients treated by low-volume and high-volume orthopaedic surgeons.

METHODS:

A healthcare database was queried for primary, elective TJAs from January 1, 2016 to December 31, 2019. The association between annual surgeon volume and 90-day incidence of PJI was modeled via a multivariate logistic regression with restricted cubic splines (RSC). Bootstrap analysis identified a changepoint in annual volume, corresponding to a maximum decrease in odds of PJI. Surgeons with annual volume greater than the changepoint were deemed high-volume and those below as low-volume. Each surgeon within a given year was treated as a unique entity (surgeon-year unit). The risk of 90-day complications of patients treated by high- and low-volume surgeons were compared.

RESULTS:

From 2016-2019, 6,791 orthopaedic surgeons performed 981,642 TJAs. The median and average annual case volumes were 24 and 60 TJAs per year, respectively. RSC demonstrated an inverse relationship between risk of PJI and surgeon volume, with a threshold of 228 cases per year. The average PJI rate of the entire cohort was 0.82% while the PJI rate among high-volume surgeons was 0.42% compared to 0.84% among low-volume surgeons ($p < 0.001$). After accounting for confounding factors, patients treated by high-volume surgeons had lower risk of PJI (aOR: 0.66, 95%-CI: 0.62-0.71), sepsis (aOR: 0.76, 95%-CI: 0.70-0.83), PE (aOR: 0.72, 95%-CI: 0.70-0.83), readmission (aOR: 0.72, 95%-CI: 0.70-0.74), and in-hospital death (aOR: 0.76, 95%-CI: 0.65-0.90). Notably, when individual surgeon PJI rates were analyzed, 771 (83.3%) high-volume and 13,029 (83.9%) low-volume surgeon-year units had PJI rates that were lower than the average for the entire surgeon cohort.

DISCUSSION AND CONCLUSION:

While the majority of low-volume and high-volume surgeons had PJI rates below the cohort average, increasing annual surgeon case volume was associated with a reduction in risk of PJI following primary, elective TJA.

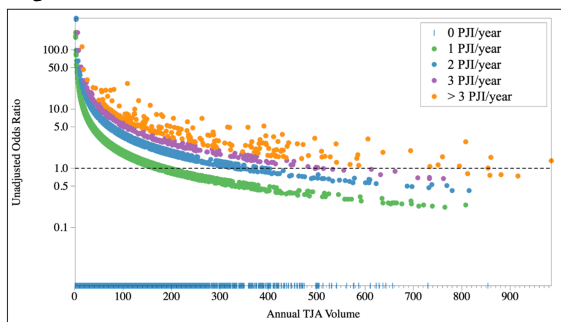


Figure 1: Unadjusted odds ratios of 90-day PJI (y-axis) and annual TJA volume (x-axis) for an individual surgeon within one calendar year. Odds ratios were calculated by comparing an individual surgeon's odds of PJI to the aggregate surgeon cohort's odds of PJI. Odds ratios are colored to indicate the number of PJIs recorded to a surgeon within a given year.

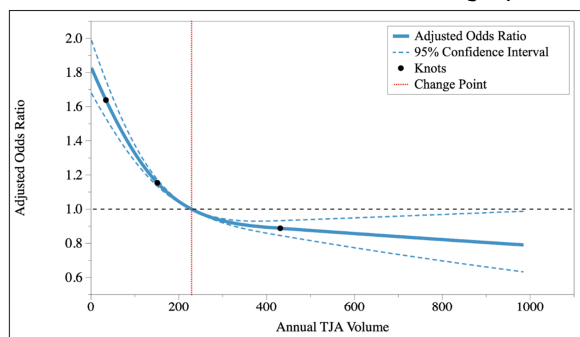


Figure 2: Adjusted odds ratio of 90-day PJI by annual TJA volume, using the changepoint (228 surgeries/year) as the comparator. The dark blue solid line corresponds to the adjusted odds ratio calculated via multivariate logistic regression with application of restricted cubic splines. Knots (black dots) were placed at 34, 151 and 434 surgeries per year. The light blue dashed lines indicate the 95% confidence interval of the predicted odds ratios.