

Projections of Total Joint Arthroplasty from 2020-2060 in Medicare Patients

Ittai Shichman, Nherera M Leo¹, Neil Askew, Itay Ashkenazi, Joseph Xavier Robin, William B Macaulay², Ran Schwarzkopf³

¹Smith + Nephew, ²NYU Langone Medical Center, ³NYU Langone Orthopedic Hospital, Hospital For Joint Diseases

INTRODUCTION:

National projections of future joint arthroplasties are useful in understanding the changing burden of surgery and related outcomes on the health system. This includes Total Hip Arthroplasty (THA), Total Knee Arthroplasty (TKA), and when combined, Total Joint Arthroplasty (TJA). The aim of this research is to update the literature in this area by producing Medicare projections for combined (primary and revision) TJA procedures until 2040 and 2060 by using past utilization data from the Center for Medicare and Medicaid services (CMS) Medicare Part B National Summary.

METHODS:

The study uses 2000-2019 data from the CMS Medicare Part B National Summary and combines procedure counts using CPT codes that related to either a Primary or Revision THA/TKA procedures. Since these procedure counts include only fee-for-service (FFS) patients and not Medicare Advantage (MA) patients, we uplifted numbers from the Part B National Summary using a ratio of FFS to MA patients provided by the Kaiser Family Foundation (KFF). In 2019, THAs and TKAs in primary and revision procedures totaled 731,746 and forms a baseline from which we project into the future.

Following this adjustment, we used 20 annual total (primary + revision) procedure counts for THAs and TKAs to generate log-linear (exponential growth) time series forecasts between 2020-2060. This model specification was chosen after comparing to other model types and presented a good fit to data in addition to adjusting for other statistical issues that are often present in simple linear time series models. No additional covariates were included in our regressions, and as such, our estimates can be considered an exponential trend when patient demographics and other factors remain the same over time. We generate point forecasts and 95% confidence intervals (CI) for each year over the forecasted time period.

RESULTS:

Our log-linear regression yields annual projections and growth rates for both THAs and TKAs, which we then combined to produce estimates for TJAs. By 2040, THAs were projected to be 0.72million (m) (CI: 0.62m, 0.82m) and TKAs were projected to be 0.81m (CI: 0.59m, 1.09m), which together estimates 1.53m (CI:1.21m, 1.91m) TJAs and equates to a 108% forecasted increase from 2019 counts. By 2060, THAs were projected to be 1.72m (CI: 1.42m, 2.09m) and TKAs were projected to be 1.42m (CI: 0.93m, 2.17m), which together estimates 3.14m (CI: 2.35m, 4.25m) TJAs and equates to a 329% increase from 2019 counts.

On average, the model projects an annual growth rate of 4.44% for THAs and 2.87% for TKAs. This has the effect of the model estimating that hip procedures make up a higher proportion of the total number of procedures over time. In 2019, Medicare data showed THAs contributed approximately 42% towards TJAs. By 2040, the model forecasts that this will become 47% and by 2060 55%.

DISCUSSION AND CONCLUSION:

We sought to take a simplistic and conservative approach in generating estimates that did not require any additional assumptions around patient demographics, and how these might change over time. The log-linear exponential model forecasts an increase in procedures from 2019 of 108% by 2040 and 329% by 2060. In addition to the estimated increase in total surgery counts, when considering resource planning it is noteworthy that hip procedures are showing a faster growth rate and are therefore projected in our models to make up a higher proportion of TJAs. This could be a finding that is only applicable to a Medicare population and we would therefore anticipate further analysis to see if this extends to other population groups.

Figure 1: THA projections (2020-2060) and 95% CI (shaded area). Data source: CMS Medicare Part B National Summary, 2000-2019.

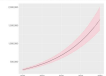


Figure 2: TKA projections (2020-2060) and 95% CI (shaded area). Data source: CMS Medicare Part B National Summary, 2000-2019.

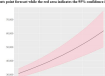


Figure 3: TJA projections (2020-2060) and 95% CI (shaded area). Data source: CMS Medicare Part B National Summary, 2000-2019.



Figure 4: Annual growth rates for THA, TKA, and TJA. Data source: CMS Medicare Part B National Summary, 2000-2019.

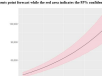


Table 1: Summary of Projections (THA and TKA) and Combined Estimates (TJA) Projections

Year	THA (m)	TKA (m)	TJA (m)
2019	0.62	0.62	1.24
2020	0.65	0.65	1.30
2030	0.85	0.85	1.70
2040	1.10	1.10	2.20
2050	1.50	1.50	3.00
2060	1.72	1.42	3.14

Table 2: Annual Growth Rates (THA and TKA) and Combined Estimates (TJA) Projections

Year	THA (%)	TKA (%)	TJA (%)
2019	4.44	2.87	3.65
2020	4.44	2.87	3.65
2030	4.44	2.87	3.65
2040	4.44	2.87	3.65
2050	4.44	2.87	3.65
2060	4.44	2.87	3.65

Table 3: Combined Total Joint Arthroplasty (TJA) Projections (million and 95% CI)

Year	THA (m)	TKA (m)	TJA (m)
2019	0.62	0.62	1.24
2020	0.65	0.65	1.30
2030	0.85	0.85	1.70
2040	1.10	1.10	2.20
2050	1.50	1.50	3.00
2060	1.72	1.42	3.14