# Have We Succeeded in Reducing the 2-Year Periprosthetic Joint Infection Incidence Rate following Total Hip Arthroplasty? A National Database Analysis from 2011 to 2019

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INTRODUCTION: Due to the significant patient morbidity and mortality associated with periprosthetic joint infection (PJI) following total hip arthroplasty (THA), there has been a push to reduce its incidence. Current clinical practice guidelines advocate for preventative methods including preoperative antibiotics, nasal decolonization, meticulous antiseptic preparation, and preoperative risk stratification. However, it remains unclear if the implementation of these methods has impacted the incidence of PJI following THA. Therefore, the purpose of this study was to examine the change in the 2-year incidence rate of PJI-indicated revisions following THA in all patients as well as those considered to be at high-risk for PJI from 2011 to 2019.

METHODS:

A retrospective observational study was performed using a national insurance database. Patients who underwent primary THA and septic revision for PJI were identified using Current Procedural Terminology (CPT) and International Classification of Diseases (ICD) procedure codes. The primary outcome was to observe the yearly change in the rates of 2-year postoperative septic revision after THA from 2011 to 2019. The secondary outcome was to conduct a subanalysis in patients considered at increased risk for PJI based on the literature. For the entire cohort, the 2-year septic revision rate was observed for each year from 2011 to 2019. Multivariable logistic regression was conducted to compare the incidence of septic revision for each year, using 2011 as the reference year and controlling for age, gender, and Charlson Comorbidity Index (CCI). The yearly septic revision rate was also recorded for different populations considered at-risk for PJI. A linear regression analysis and compounded annual growth rate (CAGR) calculation was conducted to assess the change throughout the study period for these different patient populations.

RESULTS:

In total, 412,586 patients underwent THA from 2011 to 2019, with an overall 0.43% undergoing septic revision within 2-years following THA. The rate of septic revision increased from 0.30% in 2011 to 0.50% in 2019 (CAGR: +3.43%; p<0.001). After controlling for confounders, comparing the yearly rates to that in 2011, the likelihood of septic revision surgery sequentially increased in 2015 (OR: 1.34), 2016 (OR: 1.33), 2017 (OR: 1.46), 2018 (OR: 1.47) and 2019 (OR: 1.70) (p<0.05 for all). Among patients previously considered as being high-risk for PJI, the incidence of septic revision either increased or stayed the same throughout the study period. Groups that experienced greater than average increases in septic revision rates included patients under 50 years old at surgery (CAGR=+7.59%, p=0.032), patients 50-59 years old at surgery (CAGR=+5.03%, p=0.010), and patients with a CCI of 1 (CAGR=+7.08%, p=0.001).

DISCUSSION AND CONCLUSION: Although studies have shown various infectious control modalities to be efficacious in reducing the incidence of PJI, our study of patients on a national level demonstrates an increase in the rate of 2-year septic revision. It appears that the greatest increases in septic revision are occurring in patients less than 60 years old at surgery and with a single CCI comorbidity. It is currently unknown as to why the rate may be increasing, prompting future investigators to ascertain the cause. Future efforts may focus on creating more targeted prevention strategies against PJI with recent trends in mind.

**Figure 1.** Overall trends in revision total arthroplasty for prosthetic joint infection

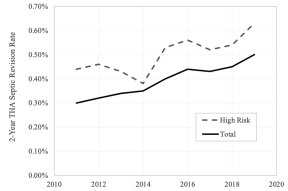


**Figure 2.** Multivariable logistic regression analysis of change in the odds of septic revision rate compared to 2011 rate, including 95% confidence interval, adjusting for age, biological sex, and Charlson Comorbidity Index

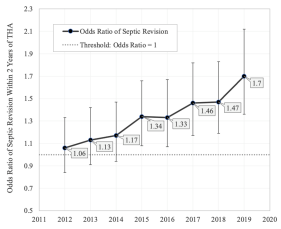


**Table 1.** Population characteristics of patients undergoing septic revision following primary total hip arthroplasty (THA)

| | % of THA patients undergoing septic revision within 2 years, by year of index procedure | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | *2011* | *2012* | *2013* | *2014* | *2015* | *2016* | *2017* | *2018* | *2019* | *CAGR* | *P-value*[*] |
| Total | 0.30 | 0.32 | 0.34 | 0.35 | 0.40 | 0.44 | 0.43 | 0.45 | 0.50 | +3.43% | **<0.001** |
| Age | - | - | - | - | - | - | - | - | - | - | - |
| <50 | 0.59 | 0.62 | 0.56 | 0.64 | 0.54 | 0.82 | 0.61 | 0.79 | 1.18 | +7.59% | **0.032** |
| 50-59 | 0.42 | 0.39 | 0.42 | 0.41 | 0.61 | 0.46 | 0.61 | 0.52 | 0.69 | +5.03% | **0.010** |
| 60-69 | 0.31 | 0.32 | 0.33 | 0.35 | 0.37 | 0.47 | 0.38 | 0.48 | 0.44 | +2.71% | **0.003** |
| 70+ | 0.10 | 0.17 | 0.21 | 0.21 | 0.21 | 0.26 | 0.29 | 0.28 | 0.29 | +1.15% | **<0.001** |
| Gender | - | - | - | - | - | - | - | - | - | - | - |
| Female | 0.24 | 0.26 | 0.28 | 0.27 | 0.35 | 0.38 | 0.36 | 0.37 | 0.44 | 3.55% | **0.020** |
| Male | 0.37 | 0.40 | 0.40 | 0.45 | 0.47 | 0.51 | 0.51 | 0.56 | 0.58 | 3.37% | **0.001** |
| CCI | - | - | - | - | - | - | - | - | - | - | - |
| 0 | 0.27 | 0.27 | 0.33 | 0.35 | 0.38 | 0.29 | 0.33 | 0.29 | 0.29 | -1.88% | 0.831 |
| 1 | 0.32 | 0.37 | 0.33 | 0.36 | 0.37 | 0.47 | 0.45 | 0.52 | 0.62 | +7.08% | **0.001** |
| 2 | 0.33 | 0.35 | 0.38 | 0.30 | 0.50 | 0.46 | 0.46 | 0.59 | 0.63 | +2.72% | 0.151 |
| 3+ | 0.36 | 0.40 | 0.34 | 0.36 | 0.42 | 0.58 | 0.51 | 0.53 | 0.55 | -0.14% | 0.322 |

Bolded values represent values significant to a threshold of p<0.05
THA, total hip arthroplasty; CAGR, cumulative annual growth rate; CCI, Charlson comorbidity index
[*]Ordinary least squares linear regression

**Table 2.** Rates of at-risk subpopulations of patients who underwent septic revision following primary total hip arthroplasty (THA)

| | % of THA patients undergoing septic revision within 2 years, by year of index procedure | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | *2011* | *2012* | *2013* | *2014* | *2015* | *2016* | *2017* | *2018* | *2019* | *CAGR* | *P-value*[*] |
| Total | 0.3 | 0.32 | 0.34 | 0.35 | 0.4 | 0.44 | 0.43 | 0.45 | 0.5 | 6.59% | **<0.001** |
| By comorbidity | - | - | - | - | - | - | - | - | - | - | - |
| High risk | 0.44 | 0.46 | 0.43 | 0.38 | 0.53 | 0.56 | 0.52 | 0.54 | 0.63 | 4.59% | **0.009** |
| Drug abuse | 0.89 | 0.88 | 0.90 | 0.70 | 1.08 | 1.06 | 0.95 | 0.90 | 1.71 | 8.51% | 0.083 |
| HIV/AIDS | 1.14 | 0.93 | 0.39 | 0.70 | 0.82 | 0.75 | 0.72 | 0.31 | 1.12 | -0.22% | 0.612 |
| Coagulopathy | 0.32 | 0.41 | 0.48 | 0.37 | 0.34 | 0.66 | 0.71 | 0.68 | 0.73 | 10.86% | **0.003** |
| Renal disease | 0.49 | 0.34 | 0.27 | 0.32 | 0.46 | 0.68 | 0.35 | 0.50 | 0.36 | -5.95% | 0.831 |
| CHF | 0.51 | 0.40 | 0.66 | 0.49 | 0.56 | 0.49 | 0.46 | 0.44 | 0.62 | 2.47% | 0.825 |
| Rheumatologic Disease | 0.58 | 0.39 | 0.62 | 0.25 | 0.55 | 0.70 | 0.69 | 0.54 | 0.44 | -3.39% | 0.701 |
| Deficiency anemia | 0.45 | 0.65 | 0.35 | 0.46 | 0.49 | 0.74 | 1.06 | 1.18 | 1.40 | 15.24% | **0.002** |
| Liver disease | 0.60 | 0.76 | 0.28 | 0.32 | 0.45 | 0.92 | 0.55 | 0.72 | 1.05 | 7.25% | 0.177 |
| Tobacco use | 0.53 | 0.52 | 0.46 | 0.40 | 0.56 | 0.73 | 0.60 | 0.59 | 0.79 | 5.12% | **0.039** |
| Obesity (BMI>30) | 0.58 | 0.56 | 0.66 | 0.52 | 0.74 | 0.69 | 0.53 | 0.65 | 0.53 | -1.12% | 0.977 |

Bolded values represent values significant to a threshold of p<0.05
THA, total hip arthroplasty; CAGR, cumulative annual growth rate; HIV, human immunodeficiency virus; AIDS, acquired immunodeficiency syndrome; CHF, congestive heart failure; BMI, body mass index
[*]Ordinary least squares linear regression