# Appendix

*Statistical Methods*

We used a stochastic poisson process to model the projected primary and revision arthroplasties and SSIs. For each gender and surgery type, we assumed a base population aged a0 at t0 equal to N(t0; α0), where t0 is our baseline year and a0 is age at baseline year. Underlying mortality, arthroplasty rates and SSI rates were applied to the base population as functions of age, µ(α), σ(α), and ρ(α) respectively. For each age-cohort N(t0; α0), we calculated the number to survive to time t = t0 + Δt without death or surgery. Our population eligible for an arthroplasty at time t aged α = α0 + Δt was equal to

The number of arthroplasties and SSIs projected in this cohort for year t was

For our purposes, we were interested in annual totals and mortality, as arthroplasty rates and SSI rates were held constant over an annual increment. Thus, the integral could be replaced by a discrete function

Where δt represents one year and Δt = k δt. Using the Poisson process, the number of arthroplasties and SSIs in a given year was Poisson distributed and the mean equaled the variance.

In order to estimate the number of SSIs following hip arthroplasty for 75 year old males in 2020, we set α = 75, and Δt = 2020 – 2015 = 5, therefore α0 = 70 and N(2015; 70) = the number of 70 year old males in 2015. To complete the calculations, we used gender-specific mortality µ for ages 70 to 74, the arthroplasty rate σ at ages 70 to 75 and the SSI rate ρ at age 75.

*Appendix Table 1. Relative risk of arthroplasty and surgical site infection (SSI) for obese and non-obese populations compared to the total population.*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Arthroplasty Relative Risk | | SSI Relative Risk | |
|  | BMI < 30 | BMI ≥ 30 | BMI < 30 | BMI ≥ 30 |
| Hip Arthroplasty | | | | |
| Male | 0.86 | 1.19 | 0.74 | 1.36 |
| Female | 1.07 | 0.92 | 0.72 | 1.54 |
| Knee Arthroplasty | | | | |
| Male | 0.59 | 1.56 | 0.86 | 1.10 |
| Female | 0.55 | 1.52 | 0.69 | 1.19 |

*Appendix Table 2. Projected 2020 to 2030 primary and revision hip and knee arthroplasties and surgical site infections (SSIs)*

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **2020** | **2021** | **2022** | **2023** | **2024** | **2025** | **2026** | **2027** | **2028** | **2029** | **2030** | **Total** |
| **Hip and Knee Arthroplasties** | | | | | | | | | | | | |
| All | 1,344,337 | 1,363,200 | 1,383,016 | 1,402,279 | 1,421,202 | 1,441,664 | 1,460,409 | 1,477,782 | 1,493,929 | 1,509,213 | 1,523,442 | 15,820,476 |
| Primary | 1,222,169 | 1,237,513 | 1,253,961 | 1,270,006 | 1,285,868 | 1,303,394 | 1,319,350 | 1,334,102 | 1,347,789 | 1,360,777 | 1,372,884 | 14,307,815 |
| Revision | 122,168 | 125,687 | 129,055 | 132,273 | 135,334 | 138,270 | 141,059 | 143,680 | 146,140 | 148,436 | 150,558 | 1,512,661 |
| **Hip and Knee Arthroplasty SSIs** | | | | | | | | | | | | |
| All | 6,569 | 6,670 | 6,775 | 6,874 | 6,972 | 7,075 | 7,171 | 7,262 | 7,350 | 7,429 | 7,505 | 77,654 |
| Primary | 4,890 | 4,946 | 5,008 | 5,068 | 5,127 | 5,194 | 5,256 | 5,315 | 5,373 | 5,425 | 5,476 | 57,080 |
| Revision | 1,679 | 1,724 | 1,767 | 1,806 | 1,845 | 1,881 | 1,915 | 1,947 | 1,977 | 2,004 | 2,029 | 20,574 |
| **Hip Arthroplasties** | | | | | | | | | | | | |
| All | 538,386 | 546,130 | 554,294 | 562,476 | 570,522 | 579,325 | 587,619 | 595,689 | 603,858 | 611,276 | 618,433 | 6,368,008 |
| Primary | 491,850 | 498,288 | 505,195 | 512,163 | 519,043 | 526,717 | 533,928 | 540,965 | 548,149 | 554,636 | 560,922 | 5,791,857 |
| Revision | 46,537 | 47,841 | 49,099 | 50,313 | 51,478 | 52,607 | 53,692 | 54,724 | 55,709 | 56,640 | 57,511 | 576,152 |
| **Knee Arthroplasties** | | | | | | | | | | | | |
| All | 805,950 | 817,071 | 828,722 | 839,803 | 850,681 | 862,341 | 872,789 | 882,094 | 890,071 | 897,937 | 905,009 | 9,452,467 |
| Primary | 730,319 | 739,225 | 748,766 | 757,843 | 766,825 | 776,677 | 785,422 | 793,137 | 799,640 | 806,141 | 811,962 | 8,515,958 |
| Revision | 75,631 | 77,846 | 79,956 | 81,960 | 83,856 | 85,663 | 87,367 | 88,956 | 90,431 | 91,796 | 93,047 | 936,509 |
| **Hip Arthroplasty SSIs** | | | | | | | | | | | | |
| All | 3,510 | 3,567 | 3,624 | 3,682 | 3,738 | 3,798 | 3,854 | 3,909 | 3,964 | 4,015 | 4,063 | 41,725 |
| Primary | 2,674 | 2,708 | 2,745 | 2,782 | 2,818 | 2,859 | 2,898 | 2,936 | 2,976 | 3,011 | 3,046 | 31,454 |
| Revision | 836 | 859 | 880 | 900 | 920 | 938 | 956 | 973 | 989 | 1,003 | 1,017 | 10,271 |
| **Knee Arthroplasty SSIs** | | | | | | | | | | | | |
| All | 3,059 | 3,104 | 3,149 | 3,192 | 3,234 | 3,278 | 3,317 | 3,353 | 3,385 | 3,415 | 3,443 | 35,929 |
| Primary | 2,216 | 2,238 | 2,263 | 2,286 | 2,309 | 2,335 | 2,358 | 2,379 | 2,397 | 2,414 | 2,430 | 25,626 |
| Revision | 843 | 865 | 887 | 906 | 925 | 943 | 959 | 974 | 988 | 1,001 | 1,012 | 10,303 |