

The impact of patient characteristics on lifetime risk of revision following knee and hip replacement: evidence from linked primary care and hospital records

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Purpose

To estimate the effect of patient characteristics on the lifetime risk of revision following total knee and hip replacement (TKR and THR).

Methods

Individuals who received TKR or THR were identified using primary care linked to hospital records in England (CPRD-HES). Based on 10-year follow-up patient-level data, parametric survival models were specified with age, gender, diagnosis of OA or RA, comorbidities (as measured by the Charlson score) and socioeconomic status (as measured by Index of Multiple Deprivation, IMD, quintile) included as explanatory variables. Alternative parametric survival models (proportional hazards, accelerated failure time, AFT, and spline models) were considered with time ratios (TRs) or hazard ratios (HRs) estimated depending on the type of model used. Choice of model was based on fit to observed data and, if required, plausibility of extrapolation. While risk of revision was extrapolated beyond follow-up, risk of mortality was assumed to revert to population lifetables after 10 years. A Markov model was used to combine the specified models for risk of revision and mortality to estimate lifetime risk of revision.

Results

10,260 TKRs and 10,961 THRs were included in the analysis. An AFT model with a Weibull distribution which was produced the best fit for risk of revision following TKR. Older age at surgery was associated with a reduced annual risk of revision, TR: 1.06 (95% confidence interval (CI): 1.04 to 1.08), while male gender was associated with an increased risk, TR: 0.70 (95% CI: 0.51 to 0.96). Being in the lowest (least deprived) IMD quintile was associated with a reduced annual risk of revision relative to being in the highest quintile, TR: 2.16 (95% CI: 1.1 to 4.27).

Spline models were the best fit for risk of revision following THR. Older age at surgery was associated with a reduced annual risk of revision, HR: 0.99 (95% CI: 0.98 to 1.00), while a diagnosis of RA rather than OA were associated with an increased annual risk of revision, HR: 1.64 (95% CI: 1.07 to 2.49). Being in the second or third lowest IMD quintile was associated with a reduced annual risk of revision relative to being in the highest quintile, with HRs of 0.56 (95% CI: 0.38 to 0.82) and 0.62 (95% CI: 0.44 to 0.87), respectively.

When combined with annual risks of mortality, only age had a significant effect on the lifetime risk of revision for both TKR and THR. For example, the lifetime risk of revision following TKR fell from 34% for a 50-year old to 3% for an 80-year-old (with all other explanatory factors held at their average).

Conclusions

Male gender was associated with an increased annual risk of revision following TKR, a diagnosis of RA was associated with an increased risk after THR, and higher socioeconomic status with an increased risk following both procedures. Younger age at time of surgery is associated with both an increased annual risk of revision following TKR and THR. When combined with risk of mortality to estimate lifetime risk, younger age at surgery was associated with a significantly increased lifetime risk of revision. Greater understanding of the influence of patient factors at the time of primary surgery on the lifetime risk of revision will help inform shared decision making between clinicians and patients.