Rationing of total knee replacement: a cost-effectiveness analysis on a large trial data set
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Record Status
This is a critical abstract of an economic evaluation that meets the criteria for inclusion on NHS EED. Each abstract contains a brief summary of the methods, the results and conclusions followed by a detailed critical assessment on the reliability of the study and the conclusions drawn.

CRD summary
The objective was to assess the cost-effectiveness of total knee replacement, in patient subgroups, defined by their Oxford Knee Score (OKS). The authors concluded that total knee replacement was highly cost-effective for most patients, and limiting surgery to those with more severe symptoms was unnecessary. The methods were good and well reported, along with the assumptions and the results. Given the scope of the study, the authors’ conclusions appear to be valid.

Type of economic evaluation
Cost-utility analysis

Study objective
The objective was to assess the cost-effectiveness of total knee replacement, in patient subgroups, defined by their Oxford Knee Score (OKS).

Interventions
Primary total knee replacement was compared with no knee replacement for all patients with bone-on-bone osteoarthritis, or for those with a low OKS, and for various subgroups of patients.

Location-setting
UK/in-patient secondary care.

Methods
Analytical approach:
The authors used data from the Knee Arthroplasty Trial (KAT; Breeman, et al. 2011, see ‘Other Publications of Related Interest’ below for bibliographic details). The time horizon was five years and the authors stated that the perspective was that of the UK NHS.

Effectiveness data:
The effectiveness data were from the KAT, which was a pragmatic, multicentre, partial-factorial, non-blinded, randomised controlled trial. A total of 2,352 patients were randomly allocated to undergo total knee replacement with or without a metal-backed tibial component, with or without patellar resurfacing, and with or without mobile bearing. Patients were followed-up for at least five years. The primary outcome was the OKS at baseline, three months after surgery, and then annually. As all patients in the KAT received surgery, the authors assumed that without surgery, they would have remained at baseline levels for the five years or until death.

Monetary benefit and utility valuations:
Within the trial, quality of life was assessed using the European Quality of life (EQ-5D) questionnaire at baseline, three months after surgery, and then annually. These patient responses were valued, using tariffs from the UK general public, to produce the utilities. Without surgery, it was assumed that patients remained at their baseline utility levels.

Measure of benefit:
The measure of benefit was quality-adjusted life-years (QALYs) gained. These were calculated for the five-year trial period, using the area-under-the-curve method. Future benefits were discounted at an annual rate of 3.5%.

Cost data:
The direct costs included those of out-patient, general practice, and physiotherapy consultations for knee treatment, and theatre time, hospital days, complications, and knee components used during first admission for total knee replacement and during any readmissions for knee treatment or revisions. The resource use was collected prospectively, during the trial. The authors assumed that without surgery, patients used no health care resources for their knee problems. The price year was 2007 to 2008. All costs were reported in UK £. Future costs were discounted at an annual rate of 3.5%.

Analysis of uncertainty:
Missing data on baseline characteristics, resource use, and quality of life were imputed using multiple imputation methods. Regression analyses were undertaken to estimate how the costs and QALYs gained from surgery varied with baseline characteristics and to predict the five-year outcomes. Bootstrapping was undertaken to capture the uncertainty around the incremental cost-utility ratios (ICURs; incremental costs per QALY gained).

Results
The average cost for all patients receiving the knee surgery was £7,458. This average cost ranged from £8,657 for patients with an OKS below nine at baseline, to £6,917 for patients with an OKS over 27. A lower OKS represented worse knee symptoms (range zero to 48).

The incremental QALYs gained for all patients receiving surgery, compared with those who did not, were 1.33. This ranged from 2.02 for patients with an OKS below nine, to 0.65 for patients with an OKS over 27.

Compared with no surgery, the ICUR with surgery was £5,623 per QALY gained for all patients, and it ranged from £3,747 for patients with an OKS of 12 to 13 at baseline, to £10,971 for patients with an OKS of 20 to 21.

At a cost-effectiveness threshold of £20,000 per QALY gained, total knee replacement was cost-effective, for the average healthy patient, with a baseline OKS of 35, in 99% of simulations.

Authors' conclusions
The authors concluded that total knee replacement was highly cost-effective for most patients, and limiting surgery to those with more severe symptoms was unnecessary.

CRD commentary
Interventions:
The intervention was reported clearly and appears to have been appropriately compared with no intervention.

Effectiveness/benefits:
The clinical, effectiveness, and quality of life data were from a large, UK multicentre, randomised controlled trial. The follow-up was over five years, allowing the evaluation of long-term cost-effectiveness. It is likely that the results from this trial were internally valid, but all patients in the trial received surgery and the authors compared total knee replacement with no surgery. So they assumed that patients who did not receive surgery remained at their baseline clinical and quality of life levels. This is likely to have been a conservative assumption, as symptoms usually aggravate over time.

Costs:
All major cost categories relevant to the stated UK NHS perspective appear to have been included. The authors reported that all the resource use data were collected prospectively in the trial, but no further details were provided. These methods and the unit costs were reported in another publication (Breeman, et al. 2011). Assumptions were needed to assess the additional costs of surgery and they appear to have been very conservative, as it is highly unlikely that patients experiencing pain due to their knee problems would use no health care resources. The price year, time horizon, discount rate, and currency were reported.

Analysis and results:
The clinical and resource use data were from one trial. The authors performed statistical analyses to assess the impact of missing data, using multiple imputation techniques. They assessed the predictors of the five-year costs and outcomes, using regression, and they assessed the impact of uncertainty, using bootstrapping. The authors reported that the main limitation to their study was that assumptions had to be made to assess the quality of life and costs for patients who did
not receive surgery, but these were highly conservative.

Concluding remarks:
The methods were good and well reported, along with the assumptions and the results. Given the scope of the study, the authors’ conclusions appear to be valid.

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