Cost-effectiveness of total hip and knee replacements for the Australian population with osteoarthritis: discrete-event simulation model

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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 evaluate the cost-effectiveness of total hip or knee replacements, in Australia, accounting for left and right joint replacements in each patient. The authors concluded that both hip and knee replacements were cost-effective. The methods were appropriate and the results were reported sufficiently. Given the scope of the analysis, the authors’ conclusions are appropriate.

Type of economic evaluation
Cost-utility analysis

Study objective
The objective was to evaluate the cost-effectiveness of total hip or knee replacements, in Australia, accounting for left and right joint replacements in each patient.

Interventions
Primary conventional total hip replacements or primary total knee replacements were compared with no surgical replacement.

Location/setting
Australia/in-patient secondary care.

Methods
Analytical approach:
A discrete-event simulation (DES) was used to assess the costs and outcomes of the interventions. DES modelling allows the individual history of a patient to be captured and evaluated. The time horizon was the lifetime of the patient. The authors reported that a health system perspective was adopted.

Effectiveness data:
The clinical and effectiveness data were from published studies and national registries. The main effectiveness parameters were the time to failure and the failure rates of joint replacements due to short-term causes. This evidence was from revision rates over seven years reported in the Australian National Joint Replacement Registry.

Monetary benefit and utility valuations:
The disability weights were derived from the Burden of Disease study to quantify the impact of osteoarthritis on quality of life. Quality of life estimates, obtained using questionnaires like the European Quality of life (EQ-5D) questionnaire and the Short Form (SF)-36 Health Survey, were converted into disability weights.

Measure of benefit:
Disability-adjusted life-years (DALYs) averted were the measure of benefit, and future benefits were discounted at an annual rate of 3%.

Cost data:
The costs included surgery (primary replacements and revisions), complications, offset costs (future costs that were offset as a result of the interventions), unrelated health care costs incurred in extended life-years after receiving joint
replacements, and patient out-of-pocket costs (including time for travel, waiting, pre-surgery visits, operation, and recuperation). The costs of surgery were from Australian diagnosis-related group information. The patient's out-of-pocket costs, offset costs, and unrelated health care costs were from published studies. The price year was 2003 and future costs were discounted at an annual rate of 3%. All costs were reported in Australian dollars (AUD).

Analysis of uncertainty:
Uncertainty distributions were allocated to all the model parameters, and 2,000 Monte Carlo simulations were conducted. One-way sensitivity analyses evaluated the impact of excluding time costs, offset costs, and unrelated health care costs.

Results
Compared with no joint replacement, the average DALYs averted were 1.7 per person with hip replacement and 1.1 per person with knee replacement.

The average cost per patient (excluding time costs) for hip replacement was AUD 6,100 with offset costs and AUD 17,000 excluding offset costs. For knee replacement it was AUD 11,000 with offset costs and AUD 21,000 excluding offset costs.

Compared with no joint replacement, the incremental cost-utility ratio (including unrelated health care costs, offset costs, and time costs) was AUD 8,600 per DALY averted for hip replacement, and AUD 17,000 per DALY averted for knee replacement.

The probabilistic sensitivity analysis showed that both hip and knee replacement were cost-effective at a threshold of AUD 50,000 per DALY averted in all simulations.

Authors’ conclusions
The authors concluded that both hip and knee replacements were cost-effective at the predefined threshold.

CRD commentary
Interventions:
The interventions were described sufficiently.

Effectiveness/benefits:
The clinical and effectiveness data were from nationwide registers and published studies. In the main article, the authors did not report how these published studies were identified or selected for use. As a result it is not clear if all the relevant information was included in the study. Further details were available in an online appendix.

Costs:
The authors explicitly reported that a health system perspective was adopted. In some analyses, they included patient time costs, which might not be considered relevant to this perspective, indicating that they took a combined health system and patient perspective. The sources for the costs were adequately reported. The time horizon, price year, discount rate, and currency were explicitly reported, which will help when reproducing the analysis or generalising the results.

Analysis and results:
The cost and outcome information was synthesised in a DES model. Details of the model structure and a diagram were provided. A probabilistic sensitivity analysis was undertaken to assess the impact of uncertainty on the model's results, but a cost-effectiveness acceptability curve was not provided, making it impossible to determine the threshold at which the interventions became cost-effective. As the main limitation to their study, the authors reported that they had to extrapolate the effects of joint replacement obtained using other instruments into disability weights, and this could have under- or over-estimated the true impact of the interventions on disability. This was due to the cost-effectiveness analysis being part of a larger project, for which a protocol had been defined and all sub-projects had to follow it.

Concluding remarks:
The methods were appropriate and the results were reported sufficiently. Given the scope of the analysis, the authors’
conclusions are appropriate.

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