The cost-effectiveness of computer-assisted navigation in total knee arthroplasty

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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
This study evaluated the cost-effectiveness of computer-assisted navigation in total knee arthroplasty for the treatment of osteoarthritis. The authors concluded that the cost-effectiveness of the intervention was not robust to variability in the cost and clinical accuracy of the system. On the whole, the methodology of the study seems satisfactory. The authors' conclusions appear appropriate.

Type of economic evaluation
Cost-utility analysis

Study objective
The study evaluated the long-term costs and effects of using computer-assisted surgery (CAS) in the treatment of patients with osteoarthritis requiring total knee arthroplasty (TKA).

Interventions
CAS (total knee replacement) was based on the deployment of a computer-assisted surgical navigation system. The comparator was total knee replacement aided by mechanical alignment guides. It appears to have represented standard practice in the authors' settings.

Location/setting
USA/ tertiary care.

Methods
Analytical approach:
The authors used a Markov model to evaluate the long-term implications of the interventions. The time horizon of the analysis was 15 years. The authors reported the study perspective to have been that of the health care system.

Effectiveness data:
The effectiveness data were derived from a non-systematic review of the literature. The authors searched PubMed and the references of retrieved articles. The search terms were reported, but not the study designs of the selected studies. Clinical estimates from the available studies were combined using weighted averages. The main parameters included probabilities of neutral alignment and revision surgery.

Monetary benefit and utility valuations:
Utility values were derived from the published literature. The methods used to derive them were not reported.

Measure of benefit:
The measure of benefit used was the quality-adjusted life-years (QALYs).

Cost data:
The cost categories included primary and revision TKA with mechanical guides, incremental direct and indirect costs for CAS equipment, and operating room costs. The costs were derived from official sources (Medicare) and through personal communication with equipment merchants. All costs were reported in US dollars ($) and for the price year 2006. They were appropriately discounted at an annual rate of 3%.

Analysis of uncertainty:
One-way sensitivity analyses were conducted on all input parameters. The ranges were derived from the literature and were explicitly reported. A range of incremental cost-effectiveness ratios (ICERs) were presented, and threshold values at which CAS resulted in cost-savings compared with mechanical guides were investigated. A Monte Carlo probabilistic sensitivity analysis was also conducted. The results were presented using a 95% confidence ellipse and cost-effectiveness acceptability curve.

Results
In comparison with mechanical guides, CAS resulted in an incremental cost of $871 and incremental benefits of 0.019 QALYs. The ICER of CAS compared with mechanical guides was $45,554 per QALY.

The results of the one-way sensitivity analyses were reported, as were the threshold values of the parameters at which the ICER remained below $50,000 per QALY.

The use of the acceptability curve approach showed that the ICER was below $50,000 per QALY in 54% of simulations, and below the threshold of $100,000 per QALY in 74% of simulations.

Authors' conclusions
The authors concluded that the cost-effectiveness of computer-assisted navigation in TKA is very sensitive to changes in the cost and clinical effectiveness of the system. Studies evaluating long-term outcomes are required.

CRD commentary
Interventions:
The interventions were clearly reported. The comparator was implicitly justified as it was current practice in the study setting.

Effectiveness/Benefits:
Model parameters were derived from published literature, but no systematic search was reported. It is not possible to judge the validity of the data given the limited information reported in this paper. Utility values were reported, but the methods used to estimate the utility weights were not described as they were taken from a published paper.

Costs:
The costs included would appear to reflect the authors’ stated perspective. The cost estimates appear to have been derived from the setting. The unit costs, discounting and the price year were well reported. A one-way sensitivity analysis was conducted and the results were presented in full. The methodology and the results of the probabilistic sensitivity analyses were reported in sufficient detail.

Results and Analysis:
The authors conducted an appropriate incremental analysis and full results were presented. The methods used throughout the economic evaluation and the sensitivity analyses were well reported. Uncertainty was investigated in all input parameters, thus increasing the generalisability and validity of the study. The authors provided a full discussion of the limitations to their study.

Concluding remarks:
Despite limited reporting in relation to the clinical and utility data, the authors provided a relatively transparent analysis. The authors’ conclusions are appropriate.

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