An economic analysis of hand transplantation in the United States
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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 assessed the cost-effectiveness of hand transplantation versus the use of a hand prosthesis, for patients with either unilateral or bilateral forearm amputations. The authors concluded that a prosthesis was the dominant strategy for unilateral hand amputation, while double hand transplantation might be economically attractive only with improvements in immunosuppression. The study was well conducted and was satisfactorily presented. The authors’ conclusions appear to be robust.

Type of economic evaluation
Cost-utility analysis

Study objective
The objective was to assess the cost-effectiveness of a hand transplant versus a hand prosthesis, for patients with unilateral or bilateral forearm amputations.

Interventions
The two strategies were hand transplantation compared with having a hand prosthesis, for both unilateral and bilateral forearm amputations.

Location/setting
USA/hospital.

Methods
Analytical approach:
The analysis was based on a decision tree, with a lifetime horizon. The authors did not explicitly state the perspective adopted.

Effectiveness data:
The clinical data were from a selection of relevant publications, including the International Registry on Hand and Composite Tissue Transplantation, which included 43 cases. The key clinical input was the risk associated with immunosuppression after hand transplantation and this was derived from published studies reporting the risk associated with immunosuppression following kidney transplantation. Other relevant clinical inputs, such as complications, were partly authors’ assumptions and partly from sources, the details of which were not reported.

Monetary benefit and utility valuations:
The utility values were elicited from a sample of 100 medical students who completed a time trade-off questionnaire, at the University of Michigan Medical School.

Measure of benefit:
Quality-adjusted life-years (QALYs) were the summary benefit measure and discounting was not reported.

Cost data:
The economic analysis included surgeon and anaesthesia fees, pre-operative and post-operative care (including psychiatric evaluation), in-patient services, out-patient clinic fees, body-powered prosthesis with a terminal device, immunosuppression, treatment of complications, and productivity losses. The costs of medical care were based on Medicare fee schedules, while the cost of immunosuppression was derived from average wholesale prices. The cost of
productivity lost was based on average US hourly wages. All costs were in US dollars ($) and the price year was 2009. A 3% annual discount rate was applied.

Analysis of uncertainty:
The mean benefit values were calculated, with 95% confidence intervals. A deterministic sensitivity analysis was carried, varying the probability of complications and the utility associated with bilateral hand transplants.

Results
With unilateral amputation, the expected QALYs were 30.00 for a prosthesis and 28.81 for a hand transplant (p=0.03). The lifetime costs were $20,653 for a prosthesis and $528,293 for a hand transplant.

With bilateral amputation, the expected QALYs were 25.20 for prostheses and 26.73 for hand transplants (p=0.01). The lifetime costs were $41,305 for prostheses and $529,315 for hand transplants.

For unilateral amputation, the fitting of a prosthesis was the dominant strategy, as it was less expensive and more effective. While, for bilateral amputation, the incremental cost per QALY gained with hand transplants over prostheses was $318,961, which was well above the accepted cost-effectiveness threshold of $50,000 per QALY.

The results of the sensitivity analysis did not alter the base-case findings.

Authors' conclusions
The authors concluded that a prosthesis was the dominant strategy for unilateral hand amputation, while double hand transplantation might be economically attractive only with improvements in immunosuppression.

CRD commentary
Interventions:
The selection of the comparators was valid as a prosthesis was the standard care for hand amputation, while a hand transplant was the new alternative. These are likely to be relevant comparators in other settings.

Effectiveness/benefits:
Most of the clinical evidence came from an international registry, which included all the official cases of hand transplantation. The remaining data were from published studies, the methods of which were not reported, and authors’ assumptions. Only a few inputs were varied in the sensitivity analysis. The utility values were elicited from a sample of students, who provided their preferences for the health conditions. Time-trade off was used to elicit the preferences, which appears to have been appropriate and was described in detail. The authors did not report discounting for the QALYs, despite the long time horizon. QALYs were an appropriate benefit measure, as they capture the impact of the interventions on the patients’ health in terms of both survival and quality of life.

Costs:
The perspective was not explicitly reported, but the analysis included a wide range of values and the perspective was that of society. A list of cost items was provided, but the unit costs and quantities of resources used were only partly presented. The sources of data and calculation methods were extensively reported. The price year and the use of discounting were clearly given and the ranges of values were presented.

Analysis and results:
The analytic approach was appropriate and the incremental analysis allowed the identification of the most cost-effective strategy. The results were clearly presented. The issue of uncertainty was only partly investigated, for the key model inputs, which were varied individually. The authors acknowledged some limitations of their analysis, such as the need for assumptions for the type of complications and risks associated with immunosuppression.

Concluding remarks:
The study was well conducted and was satisfactorily presented. The authors’ conclusions appear to be robust.
Funding
Supported by the National Institute of Arthritis and Musculoskeletal and Skin Diseases.

Bibliographic details

PubMedID
19910847

DOI
10.1097/PRS.0b013e3181c82eb6

Original Paper URL

Indexing Status
Subject indexing assigned by NLM

MeSH
Adult; Ambulatory Care Facilities /economics; Amputation, Traumatic /economics /mortality /surgery; Artificial Limbs /economics /statistics & numerical data; Cost-Benefit Analysis; Data Collection; Drug Costs; Female; Forearm /surgery; Graft Rejection /drug therapy /economics /mortality; Hand Transplantation; Hospital Costs; Humans; Immunosuppressive Agents /economics /therapeutic use; Male; Medicare /economics; Organ Transplantation /economics /mortality; Outcome and Process Assessment (Health Care) /economics; Postoperative Complications /economics /mortality; Quality-Adjusted Life Years; United States /epidemiology; Young Adult

AccessionNumber
22010000636

Date bibliographic record published
23/06/2010

Date abstract record published
04/08/2010