Cost-effectiveness of organ donation: evaluating investment into donor action and other donor initiatives


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.

Health technology
Organ donor initiatives such as Donor Action (DA) were investigated. DA is an international programme designed to increase organ donation through education and structured feedback of health professionals, allowing hospitals to improve donation rates through improved donation practices. The programme is composed of a five-step process:

(1) the consolidation of support for organ donation among senior medical personnel; followed by

(2) a two-part diagnostic review consisting of a retrospective medical record review and survey of hospital staff attitudes towards donation.

These data are then compiled into a database and a comprehensive profile of strengths and weaknesses produced.

(3) Based on gaps identified, specific programmes are tailored for individual sites using modules developed for that specific issue; then

(4) implementation of modules; and

(5) ongoing monitoring of results and improvements.

Organ transplantation in this study was compared with kidney dialysis.

Type of intervention
Treatment.

Economic study type
Cost-utility analysis.

Study population
The study population comprised a hypothetical cohort of patients selected for transplantation.

Setting
The study setting was secondary care. The economic study was undertaken in Canada.

Dates to which data relate
The effectiveness data were derived from studies and reports published between 1996 and 2002. The resource use data were derived from one study published in 1996 and institutional sources. The price year was not reported.

Source of effectiveness data

The effectiveness data were derived from a review of published studies and reports.

**Modelling**
A Markov model was developed to compare the cost-utility of cadaveric kidney transplantation with dialysis of those patients selected for transplantation but who remained on a transplant waiting list. The three states employed were transplanted, waiting on dialysis and death. The length of the Markov cycle was 1 year, with a 20-year timeframe. Half-cycle corrections were used for both the costs and benefits.

**Outcomes assessed in the review**
The outcomes assessed were:

- the cadaver graft survival rate at 1 year;
- the graft loss rate after the first year;
- the annual patient mortality rate in wait-listed dialysis patients;
- the patient survival rate at 1 year post transplant;
- the annual patient mortality rate after the first year;
- the patient mortality rate after graft loss (at year 1);
- the annual patient mortality rate after graft loss (in subsequent years);
- the death rate with a functioning graft;
- the Canadian population size;
- the number of cadaver donors per million population;
- the procured kidneys per cadaver donor;
- the increase in organ donation rate with DA; and
- the utilities associated with dialysis, transplantation in year 1, and transplantation in subsequent years.

**Study designs and other criteria for inclusion in the review**
Not reported.

**Sources searched to identify primary studies**
Not reported.

**Criteria used to ensure the validity of primary studies**
Not reported.

**Methods used to judge relevance and validity, and for extracting data**
Not reported.
Number of primary studies included
Seven studies were included in the review.

Methods of combining primary studies
Estimates from the primary studies were not combined.

Investigation of differences between primary studies
Not applicable.

Results of the review
The cadaver graft survival rate at 1 year was 0.86.
The graft loss rate after the first year was 0.048.
The annual patient mortality rate in wait-listed dialysis patients was 0.061.
The patient survival rate at 1 year post transplant was 0.95.
The annual patient mortality rate after the first year was 0.037.
The patient mortality rate after graft loss in year 1 was 0.24.
The annual patient mortality rate after graft loss in subsequent years was 0.11.
The death rate with a functioning graft was 0.28.
The Canadian population was 31.5 million.
The number of cadaver donors was 14 per million in the population.
The procured kidneys per cadaver donor were 1.64.
The increase in organ donation rate with DA 53%.
The utilities were 0.57 for dialysis, 0.70 for transplantation in year 1, and 0.70 for transplantation in subsequent years.

Measure of benefits used in the economic analysis
The measure of benefits used was the quality-adjusted life-years (QALYs). Utility values for each of the three health states identified were derived from a published study (Laupacis et al., see Other Publications of Related Interest). The health benefits were discounted at a rate of 5% per annum.

Direct costs
The resource use and costs were not reported separately. The direct costs included in the analysis were those to the health care system. These included maintenance costs (dialysis, transplantation, and dialysis originating from a failed graft), initial transplantation costs, organ procurement costs, and the costs associated with graft loss (e.g. nephrectomy). The costs were derived from a published study (Laupacis et al., see Other Publications of Related Interest). Institutional sources were, however, used to derive Canadian donor organ and transplant graft nephrectomy costs. As the costs were incurred over a period of up to 20 years, the costs were discounted at a rate of 5% per annum. The price year was not reported. The average costs per patient were reported.
Statistical analysis of costs
The costs were treated as point estimates (i.e. the data were deterministic).

Indirect Costs
The indirect costs were not included in the analysis.

Currency
Canadian dollars (Can$).

Sensitivity analysis
The authors conducted a one-way sensitivity analysis by varying the number of extra donors recruited by donor initiatives per million population (from 1 to 15 extra donors). They also conducted a one-way sensitivity analysis on the timeframe employed (from 2 to 30 years).

Estimated benefits used in the economic analysis
Waiting on dialysis resulted in 4.67 QALYs over 20 years. Transplantation resulted in 6.66 QALYs over 20 years, that is, an incremental gain of 1.99 QALYs over waiting on dialysis.

Cost results
Waiting on dialysis resulted in a cost of Can$401,810 over 20 years. Transplantation resulted in a cost of Can$297,372 over 20 years, that is, a cost-saving of $14,438 per additional individual transplanted when compared with waiting on dialysis.

Synthesis of costs and benefits
The costs and benefits were not combined as kidney transplantation was dominant (i.e. more effective and less costly than waiting on dialysis). The results of the sensitivity analysis showed that an intervention producing three incremental donors per million population would be cost-effective (using a Can$50,000 per QALY gained threshold) at a price of 1 million dollars per million population. An intervention producing 15 extra donors would be cost-effective at a price of 5 million dollars per million population. The results of the sensitivity analysis also showed that, even with a limited timeframe (of 8 years or less), cost-effectiveness thresholds were in millions of Canadian dollars per million population. As the timeframe lengthened, the cost thresholds stabilised, reflecting the effect of continual graft loss and return to dialysis.

Authors' conclusions
Initiatives to increase organ donation, such as Donor Action (DA), are likely to be cost-effective under a variety of clinical scenario.

CRD COMMENTARY - Selection of comparators
The authors justified their choice of the comparator (dialysis for those patients waiting for transplantation) by reporting that patients in need of a kidney transplant could wait upwards of 7 years on dialysis. You should decide if this is a widely used health technology in your own setting.

Validity of estimate of measure of effectiveness
It was unclear whether the authors performed a systematic review of the literature to identify relevant research and minimise biases. The authors failed to report the methods used to carry out the review. Hence, it is unclear whether all the relevant research was included. The estimates of effectiveness from studies and reports were not combined, as only
one study was used to derive each parameter in the model. Although the authors conducted a sensitivity analysis on the effectiveness of donor initiatives to increase donors, they did not conduct sensitivity analyses on other parameters, such as those associated with the effectiveness of kidney transplantation and dialysis.

Validity of estimate of measure of benefit
The estimation of benefits was modelled using a Markov model, which was appropriate. It is unclear whether the utility values, obtained from a published study, were derived from patients' preferences or experts' opinion. As the benefits could be incurred up to 20 years in the future, future QALYs were discounted at a rate of 5% per annum.

Validity of estimate of costs
It would appear that all the categories of cost relevant to the perspective adopted (the health care system) were included in the review. However, it is unclear whether all the relevant costs for each cost category were included in the analysis, as the authors did not report the resource use categories. The authors reported that cost adjustments for patient time for treatment were excluded, but it is unclear if this omission might have biased the results in favour of one of the alternatives. The costs and the quantities were not reported separately, which will limit the generalisability of the authors' results. The costs were derived from the authors' settings and published sources. No sensitivity analysis of the costs was performed, which will limit the interpretation of the study findings. Since the costs were incurred over a period of up to 20 years, all future costs were appropriately discounted. The price year was not reported, which will prevent any future inflation exercises.

Other issues
The authors compared the results from this study with another study they had conducted in Germany, which had also shown that donor initiatives were cost-effective. The issue of generalisability to other settings was partially addressed through the sensitivity analysis, although this analysis was quite limited. The authors do not appear to have presented their results selectively and their conclusions reflected the scope of the analysis.

The authors reported a number of further limitations to their study. First, the analysis ignored the effect of how the transplantation other solid organs (e.g. hearts, livers, lungs and pancreata) affects the overall cost-effectiveness of organ donation initiatives. Second, the analysis was based on conservative cost estimates generated from patients while on dialysis and up to 2 years post transplant. The authors reported that this avoided including higher dialysis costs that might accrue to untransplantable patients, although this omission might underestimate the burden of dialysis costs as patients are left on the wait list for long periods of time. Third, the study did not address the question of by how much organ donation can be increased. The underlying assumption of the analysis was that organ donation could be increased above current levels.

Implications of the study
The authors reported that organ donation in Canada is underfunded and that aggressively implemented programmes, such as DA, could be an important step to generating long-term savings and alleviating the worldwide organ shortage.

Source of funding
None stated.

Bibliographic details

Other publications of related interest


**Indexing Status**

Subject indexing assigned by NLM

**MeSH**

Canada; Cost-Benefit Analysis; Health Care Costs; Humans; Kidney Transplantation /economics /methods; Markov Chains; Quality-Adjusted Life Years; Sensitivity and Specificity; Time Factors; Tissue and Organ Procurement /economics /methods

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