Dialysis for end-stage renal disease: determining a cost-effective approach

Kirby L, Vale L

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
Continuous ambulatory peritoneal dialysis (CAPD) was compared with haemodialysis (HD) as the initial method of renal replacement therapy for end-stage renal disease.

Type of intervention
Palliative care.

Economic study type
Cost-effectiveness analysis.

Study population
The study population comprised patients with end-stage renal disease.

Setting
The setting was a hospital. The costing was carried out Scotland, UK.

Dates to which data relate
The effectiveness data were obtained from studies conducted between 1986 and 1989. The price year was 1999.

Source of effectiveness data
The effectiveness data were derived from a systematic review of the literature.

Modelling
A Markov model was used to account for the changes in health states between time periods (cycles of one month). The health states were HD, HD complications, CAPD, CAPD complications and death.

Outcomes assessed in the review
The review produced transition probabilities between the five health states to populate the model.

Study designs and other criteria for inclusion in the review
The authors stated that they could not find any completed randomised controlled trials. They therefore used observational studies.

Sources searched to identify primary studies
A published search strategy (see Other Publications of Related Interest) was used to identify the primary studies, although details of the sources used were not provided.

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
Three studies were included in the review.

Methods of combining primary studies
Not reported.

Investigation of differences between primary studies
Not reported.

Results of the review
Some transitions were impossible, for example, death to any other state, and death between one time and another time. These transitions therefore had a probability of zero. The probabilities for the other health state transitions were as follows.

For HD to HD: 0.925 (high) and 0.939 (low) in the first year, and 0.983 in subsequent years.
For HD to HD complications: 0.06 (high) and 0.06 (low) in the first year, and 0.003 in subsequent years.
For HD to death: 0.015 (high) and 0.001 (low) in the first year, and 0.015 in subsequent years.
For HD complications to HD: 0.961 (high) and 0.991 (low) in the first year, and 0.980 in subsequent years.
For HD complications to CAPD: 0.024 (high) and 0.008 (low) in the first year, and 0.005 in subsequent years.
For HD complications to death: 0.015 (high) and 0.001 (low) in the first year, and 0.015 in subsequent years.
For CAPD to CAPD: 0.759 (high) and 0.762 (low) in the first year, and 0.968 in subsequent years.
For CAPD to CAPD complications: 0.228 (high) and 0.228 (low) in the first year, and 0.017 in subsequent years.
For CAPD to death: 0.014 (high) and 0.011 (low) in the first year, and 0.015 in subsequent years.
For CAPD complications to HD: 0.024 (high) and 0.013 (low) in the first year, and 0.015 in subsequent years.
For CAPD complications to CAPD: 0.962 (high) and 0.976 (low) in the first year, and 0.970 in subsequent years.
For CAPD complications to death: 0.014 (high) and 0.011 (low) in the first year, and 0.015 in subsequent years.

Methods used to derive estimates of effectiveness
The authors made some assumptions about the effectiveness.
Estimates of effectiveness and key assumptions
The patients could only switch treatment modality after experiencing a complication and not by, for example, preference.

The patients would spend one time period in the state of complication.

Measure of benefits used in the economic analysis
The measure of benefit was the number of life-years gained.

Direct costs
It was stated that the costs were calculated from the resource use at Grampian University Royal Hospitals NHS Trust (GUHT), and from studies of state of health and access surgery (creating arterial venous fistula and catheter insertion).

The direct cost categories were nursing, consultant and junior doctor time, consumables, capital and overheads.

The nursing costs for CAPD and HD treatment, and for treating a complication, were calculated from the duty list of the renal ward for a standard week. The cost per patient was based on the proportion of CAPD and HD patients using the ward on a weekly basis. Doctor time was based on two whole-time equivalent consultants, 20% of a house officer and one full-time staff grade doctor. The cost per patient was estimated on the basis of length of stay. The capital costs were calculated using the cost data obtained from the GUHT.

For treating a complication, a care episode was defined using clinical advice and care protocols. The resources used were then identified and costed. For access surgery, the staffing costs were obtained from surgery departments, whilst the capital costs were annuitised using a 6% discount rate. The cost per patient was then calculated by dividing the equivalent annual cost of one operating room by the annual number of patients passing through it. The price year was 1999.

The unit costs were local prices and the drug costs from the British National Formulary.

Statistical analysis of costs
The costs were reported as the "average" monthly cost. No statistical analysis was performed. Any uncertainty was dealt with in the sensitivity analyses.

Indirect Costs
The indirect costs were not reported.

Currency
UK pounds sterling (£).

Sensitivity analysis
The effect of a three-way analysis on incremental cost-effectiveness (per life-year) was presented. This varied the discount rates, costs and transition probabilities. The cost and probability values used were labelled as high or low. The corresponding resource quantities and unit costs were not given for the costs. It was not stated how the probabilities were combined to produce the high and low estimates. The discount rates were 0, 6 and 10%.

Estimated benefits used in the economic analysis
The high and low estimates of survival and probabilities were combined for HD and CAPD. Thus 16 scenarios were
presented for HD compared with CAPD, for each discount rate. At a discount rate of 0%, the total incremental survival (HD minus CAPD) was:

- for HD (high probability and high survival) and CAPD (high probability and high survival), 0.2 life-years;
- for HD (high probability and high survival) and CAPD (low probability and low survival), 0.02 life-years;
- for HD (low probability and low survival) and CAPD (high probability and high survival), 0.82 life-years; and
- for HD (low probability and low survival) and CAPD (low probability and low survival), 0.64 life-years.

**Cost results**
Similarly, the total incremental cost (HD minus CAPD) was given for each of the 16 combinations of either low or high probabilities and costs. At a discount rate of 0%, the total incremental cost for the extreme scenarios was:

- for HD (high probability and low cost) and CAPD (low probability and high cost), -13,056; and
- for HD (low probability and high cost) and CAPD (high probability and low cost), 14,417.

**Synthesis of costs and benefits**
The incremental cost-effectiveness (per life year) was also given for the various combinations at the three discount rates.

Regardless of the discount rate, HD dominated (i.e. was more effective and less costly) CAPD in 8 of the 16 scenarios, and always where the HD probability was high and the cost was low. In the other scenarios, HD was more effective and cost more. The highest cost-effectiveness was for HD (high probability and high cost) and CAPD (low probability and low cost). The cost-effectiveness was 40,414 at a discount rate of 0%, rising to 50,122 at a discount rate of 10%.

**Authors’ conclusions**
"It may be more cost-effective to manage patients starting on renal replacement therapy with hospital haemodialysis than continuous ambulatory peritoneal dialysis (CAPD)."

**CRD COMMENTARY - Selection of comparators**
The selection of the comparator was justified by reference to the medical literature. You must consider whether these technologies are applicable in your setting.

**Validity of estimate of measure of effectiveness**
The sources of the primary studies were not reported. In addition, there was no information on the methods used to select and assess the studies, and to extract the data. The use of a published search strategy increased the validity of the review. However, as the authors stated, the internal validity of the studies may be questionable due to their observational nature. Also, only three studies were obtained, and it was not stated how the estimates from the studies were used to provide the probabilities used in the model. The assumption that the patients were only able to switch treatment because of complications does not take into account other reasons for switching. However, the magnitude of any effect this would cause is not known.

**Validity of estimate of measure of benefit**
The number of life-years gained was an appropriate measure of health benefit, which enabled comparison with other technologies. However, other measures of health-related benefits, such as quality of life or individual preferences, would have been useful.
Validity of estimate of costs
All direct cost categories relevant to the perspective of a hospital seem to have been included. However, costs to the patient or the carer, in terms of time, might differ significantly between HD and CAPD. Also, although the method of deriving costs was given, the actual resource quantities and unit costs were not, thus reducing the generalisability to other settings. However, the price year was stated, thus allowing reflation exercises to be performed. In addition, an incremental analysis was carried out, which facilitated the decision on the adoption of the technology. A sensitivity analysis took into account any uncertainty in the effectiveness, costs and discount rate. Unfortunately, it was unclear how the effectiveness ranges were derived from the literature, or to what extent the cost ranges represented plausible differences in the unit costs or resource quantities.

Other issues
The authors addressed the issue generalisability using a sensitivity analysis, and compared their results with those from other studies. They did not seem to present the results selectively and their conclusions were in keeping with the population studied. The authors identified the limitations in their study, which included those already highlighted and the choice of the comparator. Other technologies were available, but the authors stated that these were either not widely used in the UK or have already been researched.

Implications of the study
The authors stated that the finding that it may be more cost-effective to treat patients starting on renal replacement therapy with HD rather than with CAPD, could have particular implications for the UK given that up to 50% of new patients receive CAPD. In fact, the evidence showed that HD either dominated CAPD or was more effective, but cost more. In the latter case, in order to know whether HD is more cost-effective than CAPD, one would also need another comparator. Then, the cost-effectiveness of CAPD in comparison to this technology could be found. Such a comparator would be the next best technology. The authors also recommended more robust but pragmatic primary research.

Source of funding
The Chief Scientist Office of the Scottish Executive Health Department funds HERU and HSRU.

Bibliographic details

PubMedID
11446130

Other publications of related interest

Indexing Status
Subject indexing assigned by NLM

MeSH
Cost-Benefit Analysis /methods; Health Care Costs /statistics & numerical data; Humans; Kidney Failure, Chronic /economics /therapy; Markov Chains; Peritoneal Dialysis, Continuous Ambulatory /economics; Renal Dialysis /economics; Scotland; Technology Assessment, Biomedical /economics /methods

AccessionNumber
22001008129