Comparison of haemodialysis and peritoneal dialysis: a cost-utility analysis

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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.

Health technology
The use of haemodialysis (HD) and peritoneal dialysis (PD) in patients with chronic kidney failure.

Type of intervention
Treatment.

Economic study type
Cost-effectiveness and cost-utility analyses.

Study population
The study population comprised patients with chronic kidney failure. Patients with any contraindications relating to either treatment were excluded.

Setting
The setting was a dialysis department. The economic study was carried out in the south eastern health-care region of Sweden.

Dates to which data relate
The effectiveness evidence and resource use data were gathered from 1990 to 1993 and in 1999. The price year appears to have been 1998.

Source of effectiveness data
The effectiveness evidence was derived from a single study.

Link between effectiveness and cost data
The costing was undertaken retrospectively on the same patient sample as that used in the effectiveness analysis.

Study sample
Power calculations to determine the sample size were not performed. Two separate patient samples were considered.

A sample of 386 individual case records was retrospectively reviewed. This consisted of all patients who began dialysis treatment during the period 1990 to 1993 at all dialysis centres in the southeastern health-care region of Sweden. Patients undergoing HD were matched with those who underwent PD. The matching was carried out on the basis of their age, presence of diabetes, acceptance for transplantation, presence of heart disease (angina pectoris, myocardial infarction, heart failure), type of housing, family situation, and country of birth (with respect to ability to understand Swedish). Sixty-eight pairs were satisfactorily matched. The mean age was 53.2 years in the HD group and 51.7 in the
PD group. Diabetes was not present in 68% of the patients in both groups. Fifty-four per cent of the patients were accepted for transplantation.

A second sample of 438 patients, alive and being treated with dialysis or alive after having received a kidney transplant, was prospectively assessed in 1999 to derive the utility values. The patients were matched in triplets, consisting of one patient receiving HD, one patient receiving PD, and one patient with a kidney transplant. This matching resulted in 46 triplets (138 patients). Twenty-seven triplets (81 patients) were finally assessed.

Generally, there were no statistically significant differences between the patients who responded and those who did not participate in the study. The exception was the greater number of deaths among the non-responders.

**Study design**

The main analysis was based on a pair-matched case-control study, carried out retrospectively. The number of centres in which the study was carried out was not reported. The patients’ records were reviewed for 5 years. No loss to follow-up occurred as patients providing full data were selected. The outcomes were assessed by a registered nurse who examined all of the records. A cohort of patients was then prospectively assessed to derive the utility values used in the economic analysis.

**Analysis of effectiveness**

The basis of the analysis was treatment completers. However, all patients included in the final samples were included in the analysis. The primary health outcomes assessed were the parameters associated with different events in the model. These included the rates of transplantation and mortality, the probability of receiving a kidney transplantation, the 5-year survival rate, the number of patients remaining on their initial treatment, and the rate of death.

The second analysis measured the health-related quality of life of patients who were treated with dialysis or who had a kidney transplant. This was conducted using the EuroQol, an established questionnaire. The comparability of the patients within the two study groups was obtained during the matching process.

**Effectiveness results**

The rates of transplantation and mortality were generally similar in the study groups. The exception was the age group 41 to 60 years in which, after 5 years, the rate of transplantation in the PD group was 54% higher than that in the HD group.

The probability of receiving a kidney transplantation was 50% in the PD group and 41% in the HD group.

The 5-year survival rate was 56% in the PD group and 57% in the HD group.

The percentage of patients remaining on their initial treatment was 33.8% in the PD group and 42.6% in the HD group.

The rate of death was 44% in the PD group and 43% in the HD group.

The utility values were:

- 0.86 (range: 0.556 - 1; standard deviation, SD: 0.133; 95% confidence interval, CI: 0.805 - 0.915) for patients with a kidney transplant,
- 0.65 (range: 0.433 - 1; SD: 0.148; 95% CI: 0.589 - 0.711) for patients on PD,
- 0.44 (range: 0.312 - 0.62; SD: 0.083; 95% CI: 0.406 - 0.474) for patients on HD,
- 0.63 for patients on PD and with infection,
- 0.42 for patients on HD and with infection, and
Clinical conclusions
The two primary treatment methods for chronic kidney failure resulted in similar transplantation rates and similar survival.

Modelling
A decision analytic model was constructed to calculate the costs and health outcomes for HD and PD over a period of 5 years. The model was populated with data collected retrospectively for resource use and survival, and prospectively for the health-related quality of life. The five possible health states included in the model were the patient continued with the initial treatment, changed the treatment method, had a kidney transplant, acquired infection, or died. Each cycle in the model lasted 6 months, with the exception of the state of infection, which lasted 2 weeks.

Measure of benefits used in the economic analysis
The benefit measure used in the economic analysis was the quality-adjusted life-year (QALY). This was obtained by combining the quality weights and survival, both of which were derived from the effectiveness analysis. Future benefits were discounted at a rate of 3%.

Direct costs
A 3% discount rate was used as the costs were incurred over 5 years. The average costs were reported. The direct costs included in the economic analysis referred to staff, external activities, activity-related material, other activity costs, inpatient care, secretarial costs, depreciation, financial costs, and transportation to and from the clinic. The costs for external activities included analyses, anaesthesia, X-rays and consultation. The costs for activity-related material included pharmaceuticals, fluids, dialyser, testing and bandage materials, chemicals and provisions. Other activity costs included rent, cleaning, porters and technicians, laundry, communication and administration. The cost of kidney transplantation was also included when incurred.

The cost/resource boundary adopted reflected the perspective of the study. The costs were estimated using actual data derived from the respective dialysis departments. The resource use was estimated using the patients' records used in the effectiveness analysis. The price year appears to have been 1998.

Statistical analysis of costs
No statistical analysis of the costs was carried out.

Indirect Costs
A 3% discount rate was used for the indirect costs occurring over a 5-year period. The average costs were reported. The indirect costs were calculated from the estimated spare time lost by the patients and relatives, the estimated working time lost by the patients, and home care. Experts estimated these lost time values. The source of the indirect cost data was the Swedish National Road Administration and the wage for industrial workers. The treatment time for HD was 12 to 15 hours per week and travel time was about 3 hours per week. It was assumed to consist of lost working time for patients of working age and of spare time for patients older than 65 years of age. The treatment time for PD was 2 hours per day. It was assumed to consist of 1.5 hours of lost working time and 0.5 hours of lost spare time for patients of working age, and exclusively of spare time for patients older than 65 years of age. The lost spare time for relatives was 2 hours per day, on average. The price year was not reported.

Currency
US dollars ($).
Sensitivity analysis
Sensitivity analyses were carried out to take account of uncertainty around some of the input data. One-way variations were carried out on the cost for inpatient care, the costs for external activities, and HD costs. In addition, it was assessed how much the contribution of spare time on the part of relatives had to increase in PD patients for the total costs to be the same as for HD patients. Finally, to assess the impact of differences in transplantation rate on the estimated costs per QALY, the same transplantation rate was used for both groups.

Estimated benefits used in the economic analysis
The total QALYs of each intervention were not reported.

Cost results
The total expected monthly costs were $8,257 for HD and $6,240 for PD.

The total expected costs per patient during the first 5 years of treatment were $222,450 for HD and $201,000 for PD.

Synthesis of costs and benefits
Average cost-effectiveness and cost-utility analyses were carried out to combine the costs and benefits of the interventions.

The total discounted cost per life-year per patient over the 5-year period was $56,960 for PD and $62,990 for HD. In particular, it was $45,450 for PD and $46,350 for HD in the age class 21 to 40 years, $56,080 (PD) and $69,240 (HD) in the age class 41 to 60 years, and $77,510 (PD) and $81,340 (HD) in the age class 61 years and over.

The total discounted cost per QALY over the 5-year period was $82,470 for PD and $98,530 for HD. In particular, it was $55,120 for PD and $63,280 for HD in the age class 21 to 40 years, $78,910 (PD) and $114,240 (HD) in the age class 41 to 60 years, and $134,210 (PD) and $152,490 (HD) in the age class 61 years and over.

The estimated cost per QALY was robust to the variations carried out in the sensitivity analyses.

Authors’ conclusions
The effectiveness analyses indicated that the outcomes of the two interventions were similar. However, the economic analysis showed that the expected costs, both per quality-adjusted life-year (QALY) and per life-year, were more favourable for peritoneal dialysis (PD) as the primary method of treatment for patients eligible for both PD and haemodialysis (HD).

CRD COMMENTARY - Selection of comparators
The rationale for the choice of the comparator was clear. PD and HD were selected as they represented alternative treatment options for patients with chronic kidney failure. You should assess whether they represent widely used interventions in your own setting.

Validity of estimate of measure of effectiveness
The analysis of effectiveness used a pair-matched case-control study, which was carried out retrospectively. The study groups were comparable at baseline and the study sample was representative of the study population. However, bias and confounding factors may not have been excluded due to the lack of randomisation. A further prospective analysis was performed to derive the health-related utility values. In this case, there was a difference (death rate) between those who participated in the study and those who did not respond. Thus, the quality of life may have been overestimated in the study. Power calculations were not carried out. In addition, the authors noted that the follow-up period may not have been adequate to assess the long-term effects of the interventions.
Validity of estimate of measure of benefit
The benefit measure used in the economic analysis was the number of QALYs gained with each intervention. This was derived from modelling and was appropriately discounted. The use of QALYs allows comparison with other interventions in the health care system. However, it should be noted that the utility weights were derived from a patient sample different from that used to derive the survival data.

Validity of estimate of costs
All the categories of costs relevant to the perspective adopted in the study were included in the analysis. The indirect costs were considered, although the authors noted that there was some uncertainty in the estimation of both the direct and indirect costs. A complete breakdown of the costs was given. The costs were treated deterministically, but several sensitivity analyses were carried out. The price year was implicitly reported for the direct costs, but not for the indirect costs. The costs were specific to the Swedish setting.

Other issues
The authors used average cost-effectiveness and cost-utility measures. The analysis would have benefited from incremental analyses, which are more informative for the decision-maker. The authors made some comparisons of their findings with those from other studies. The issue of the generalisability of the study results to other settings was not explicitly addressed, although sensitivity analyses were carried out. The study enrolled patients with chronic kidney failure and this was reflected in the conclusions of the analysis. The authors acknowledged that there were some limitations in their analysis. These were mainly related to uncertainty around the cost data and the limited follow-up.

Implications of the study
The authors suggest that PD offers a better cost-utility ratio than HD for the treatment of patients with chronic kidney failure. Future research should adopt a longer time horizon in the analysis.

Source of funding
Funded by the Research Council of Southeastern Sweden (FORSS) and the County Council in Ostergotland, Sweden.

Bibliographic details

PubMedID
11929142

Indexing Status
Subject indexing assigned by NLM

MeSH
Cost-Benefit Analysis; Decision Trees; Health Care Costs; Humans; Kidney Failure, Chronic /economics /therapy; Middle Aged; Models, Economic; Peritoneal Dialysis /economics; Quality of Life; Quality-Adjusted Life Years; Renal Dialysis /economics; Retrospective Studies

AccessionNumber
22002000582

Date bibliographic record published
28/02/2003

Date abstract record published