Length of stay and costs for hospitalized hemodialysis patients: nephrologists versus internists
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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
Nephrology services or internal medicine services in the management of chronic hemodialysis patients admitted to medical services for a variety of medical problems. Throughout the study period hemodialysis patients were prospectively and consecutively admitted on alternate days to services attended by either internal medicine physicians or by nephrologists. The decision to admit a particular patient was generally made by either a nephrologist at a dialysis unit or by an attending physician in the study centre. Whenever hemodialysis patients were admitted to general medical services, a nephrology consultation was obtained.

Type of intervention
Treatment.

Economic study type
Cost-effectiveness analysis.

Study population
Adult patients on chronic hemodialysis who were admitted to the medical services of an institution. Patients who were hospitalised during the study period for initiation of chronic hemodialysis were also eligible for entry into the study. Admissions to non-medical services, and admissions for overnight observation, (less than 24 hours), as well as patients who were transferred from one service to another, were excluded. Admissions for catheter-related infections were eligible for inclusion in the study.

Setting
Hospital (tertiary care centre). The economic analysis was carried out in the USA.

Dates to which data relate
Effectiveness and resource use data corresponded to the period between July 1995 and March 1996. The price year was not specified.

Source of effectiveness data
The evidence for the final outcomes was based on a single study.

Link between effectiveness and cost data
Costing was performed on the same patient sample as that used in the effectiveness analysis and appears to have been conducted retrospectively.
Study sample
Power calculations were used to determine the sample size: it was estimated that a sample size of 172 to 212 admissions would be needed to detect a difference of 3 days (based on previous experience) in hospitalisation between the two groups, with a two-sided p-value of 0.05. The study sample consisted of 161 patients admitted a total of 219 times. 114 with a mean (SD) age of 57 (16) years were admitted to the nephrology group and 105 with a mean (SD) age of 50 (16) years were admitted to the internal medicine group, (p=0.005 for the age difference).

Study design
This was a prospective cohort study, carried out in a single centre. Patients were followed-up until 90 days after discharge. The study appears to have had no loss to follow-up. Participants were admitted consecutively to either service on an alternate-day basis. In terms of blinding, none of the patients was aware of the study during the months that data were being collected. One of the authors was aware of the study, but no other physicians from the internal medicine or nephrology services were aware of the study. An individual patient could be included in the study more than once if he or she was hospitalised more than once. Information on duration of dialysis, cause of end-stage renal disease (ESRD), and death outcomes was obtained from the study hospital medical record, and, when necessary, by contacting each patient’s outpatient hemodialysis unit.

Analysis of effectiveness
The principle used in the analysis of effectiveness (intention to treat or treatment completers) was not explicitly specified. The health outcomes were length of stay, predicted length of stay, risk of readmission, and mortality rate within 90 days of discharge. The Social Security Death Index was searched for death information on patients who reached specified end points within 90 days of hospital discharge. The study groups were comparable in terms of gender, race, duration of dialysis before admission, and distribution of diabetic patients at the time of hospitalisation. However, the patient groups were significantly different in terms of age and unknown cause of ESRD. The effectiveness analyses were performed with and without data from the month of January 1996, because one of the study authors was covering the nephrology service at that time. These analyses were also performed with and without the inclusion of admissions to the intensive care units.

Effectiveness results
The mean length of stay for admission to the nephrology service was 6.3 days (first and third quartiles, 2 - 8) compared with 8.1 (4 - 9) days for admissions to internal medicine services, (p=0.017). The predicted length of stay was similar. The risk of readmission was 24% for nephrologists and 30% for internists, (p=0.328). Death within 90 days of discharge was 12% for the nephrology group and 22% for the internal medicine group, (p=0.07), resulting in a relative risk of death of 1.76 (95% CI: 0.94 - 3.30; p=0.182).

Clinical conclusions
Importantly, the risk of readmission or death did not differ between the two groups, despite a shorter length of stay. The potential explanations for these findings are likely to be structural and multifaceted. The following possible explanations were put forward:

nephrologists, as the primary care providers for chronic hemodialysis patients at the study institution and in charge of providing continuity of care, had the chance to initiate care before a patient’s hospitalisation;

they had a better opportunity to ensure follow-up after discharge;

the consultative process is inherently inefficient because of delays in both the call for consultation from the time a patient is admitted, and the subsequent implementations of the nephrology recommendations; and

inherent differences in training between nephrologists and internists may partially explain the observations.
Measure of benefits used in the economic analysis
No summary benefit measure was identified in the economic analysis, and only individual clinical outcomes were reported, as shown above in the effectiveness results.

Direct costs
Costs were not discounted, which was appropriate given the short time frame of the cost analysis. Some quantities were reported separately from the costs and cost items were reported separately. The cost analysis covered the costs of diagnostic tests, dialysis, laboratory, routine costs (including costs from the floor where the patient was physically located), respiratory therapy, pharmacy, procedures, and supplies. The perspective adopted in the cost analysis appears to have been that of the hospital. The institution's cost-accounting system calculated the costs using the hospital's master file of discharge on all hemodialysis patients. It was reported that the costs were not based on adjusted insurance charges or fees collected. The price year was not specified.

Statistical analysis of costs
Wilcoxon rank sum tests were used to compare overall costs, cost categories, and average costs per day. Predicted costs were calculated employing a risk adjustment method, using a combination of DRG codes and the Sachs Complications Profiler, in conjunction with data on specific patient characteristics (age, urgency of admission, payer class) to construct regression models that assigned predicted values of costs for individuals at the time of admission.

Indirect Costs
Indirect costs were not included.

Currency
US dollars ($).

Sensitivity analysis
No sensitivity analysis was carried out.

Estimated benefits used in the economic analysis
Not applicable.

Cost results
The average total cost per admission was $2,848 more for hemodialysis patients admitted to an internal medicine service than for those admitted to the nephrology service: $7,925 (first and third quartiles, $3,342 to 10,125) compared to $10,773 ($4,023 to 11,239), (p=0.101).

Synthesis of costs and benefits
Costs and benefits were not combined.

Authors' conclusions
The length of stay was significantly shorter for hemodialysis patients under the care of nephrologists compared with internists. The average total costs and risk of readmissions tended to be lower for nephrologists. If these results are corroborated, the care of hemodialysis patients by the nephrologist could diminish the overall expense of the ESRD program.
CRD COMMENTARY - Selection of comparators
No specific technology appears to have been regarded as the comparator. You, as a database user, should consider which one of these two approaches is widely used in your own setting.

Validity of estimate of measure of effectiveness
The internal validity of the effectiveness results cannot be guaranteed due to the non-randomised nature of the study design and the non-comparability of the study groups in some of their baseline characteristics. Although it was deemed that the method of enrolment (allocation of patients between the services on an alternate-day basis) improved the possibility of the groups being similar at baseline. Furthermore, it was asserted that the study was prospective in design, although some of the clinical outcomes, such as the mortality rate within 90 days of discharge, were collected from an official index (which was, presumably, retrospective). However, the conduct of power calculations and subgroup analyses may have enhanced its validity. The study groups were comparable in terms of gender, race, duration of dialysis before admission, and distribution of diabetic patients at the time of hospitalisation. The authors acknowledged that the study did not explicitly measure disease severity in admitted patients, although comparison of diagnostic related group (DRG) codes (as a proxy for severity of disease) did not reveal any statistically significant differences between the groups. The study sample appears to have been representative of the study population. The authors acknowledged that the fact that no comparisons of the quality of care received by the study patients were made was one of the limitations of the study.

Validity of estimate of measure of benefit
The authors did not derive a measure of health benefit. The analysis was therefore of cost-consequences design.

Validity of estimate of costs
Features of the cost analysis which enhanced the validity of the cost results were: some quantities were reported separately from the costs; adequate details of the methods of cost estimation were given; the perspective adopted in the cost analysis was implicitly reported; true costs were used instead of charges; and statistical analyses were performed on resource use and cost data. However, limitations to the study include the absence of a reported price year, the retrospective nature of the costing (which may introduce bias into the calculations) and the fact that the effects of alternative procedures on indirect costs were not addressed. The authors acknowledge that the cost results may not be generalisable to other countries.

Other issues
Given the limitations of the study design, the results may need to be treated with some degree of caution. The issue of generalisability to other settings was addressed by noting that the study results cannot be generalised to other hospitals because the training experience of internists was deemed likely to vary by hospital and region. The issue of generalisability to other countries was not addressed. Informative comparisons were made with other studies. In terms of whether the study sample was representative of the study population, it was reported that the predominance of black patients in this study (62% of the nephrology service admissions and 66% of the internal medicine service admissions) was representative of the ESRD analysis population in North Carolina. Due to the chronic nature of the disease it might have been more appropriate to adopt a cost-utility approach to incorporate the subjective assessment of the patients themselves in the analysis. The authors acknowledged that the study was not powered to detect statistically significant differences in average costs of less than $3,000 or in risks of readmission less than 10%. It was deemed that, based on the trends observed in the study, extrapolating the observed differences over a longer follow-up period would likely make both differences statistically significant.

Implications of the study
Additional studies will be required to measure quality of care outcomes. The authors believed that because the results cannot easily be generalised to other settings, this type of analysis would need to be repeated in other hospitals or in a multicentre fashion throughout the United States.
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