Cost effectiveness of early discharge after uncomplicated acute myocardial infarction

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 management of care after acute myocardial infarction (MI) was examined. This comprised either early discharge, or prolonging hospitalisation for an extra day beyond the 72 hours after thrombosis.

Type of intervention
Treatment.

Economic study type
Cost-effectiveness analysis.

Study population
The study population comprised patients with uncomplicated acute MI. Patients were excluded if there was evidence of angiographically important disease in three vessels or the left main coronary artery, or if they had elective bypass surgery more than 3 days after thrombolysis. Also excluded were those patients with insufficient data on complications.

Setting
The setting was secondary care. The economic analysis was carried out in the USA.

Dates to which data relate
The effectiveness and resource data were gathered from a single study published in 1993. Resource data were also gathered from the Duke Transition one cost-accounting system. However, the relevant dates were not provided.

Source of effectiveness data
The effectiveness data were derived from a single study.

Link between effectiveness and cost data
The costing was performed retrospectively on the same patient sample as that included in the effectiveness study.

Study sample
The effectiveness data were derived from a sub-group from the Global Utilisation of Streptokinase and Tissue Plasminogen Activator for Occluded Coronary Arteries (GUSTO-1) trial. In this trial, the patients were randomly assigned to one of four thrombolytic-treatment groups if they presented more than 20 minutes, but less than 6 hours, after the onset of symptoms of acute MI, had ST-segment elevation of at least 0.1 mV in at least two limb leads or at least 0.2 mV in at least two contiguous precordial leads, and had no protocol-specified contraindications to enrolment. After exclusion, the final number of patients with acute MI included in the analysis was 38,911. Of these, 16,550 had complications and 22,361 had an uncomplicated course for 72 hours after thrombolysis.
**Study design**
The GUSTO-1 trial was a randomised trial. Few details were provided as the authors referred to the paper reporting this trial (The GUSTO Investigators, see Other Publications of Related Interest).

**Analysis of effectiveness**
It is likely that the analysis of effectiveness was limited to those patients whose follow-up data were available. The health outcomes used were:

- the incidence of ventricular arrhythmia during the next 24 hours,
- the success of resuscitation,
- the natural mortality rate, and
- survival (estimated using the Kaplan Meier approach).

A Cox proportional-hazards model for extending survival to 15 years with a Gompertz function was used to extrapolate the tail of the survival curve. Patients with complications were older and more likely to have diabetes mellitus, prior angina and prior MI than those patients with an uncomplicated course.

**Effectiveness results**
Of the patients with an uncomplicated course within 72 hours after thrombolysis, 16 had ventricular arrhythmia during the next 24 hours. Of these patients, 13 (81%) survived for at least 24 hours.

**Clinical conclusions**
The authors did not report a clinical conclusion.

**Modelling**
A decision-analytic model was constructed using Treeage software to examine the cost-effectiveness of the alternative strategies. The time horizon was until death. The decision tree was depicted graphically in the paper. The authors then made several assumptions:

- the rate of later cardiac events after thrombolysis in patients who were in the hospital was similar to that in patients who had been discharged;
- discharge at 72 hours was feasible, and testing and care not accomplished within 72 hours could effectively be shifted to the outpatient setting with no incremental costs beyond those of inpatient care;
- patients who had major complications that did not lead to cardiac arrest could return to the hospital promptly enough for any change in their long-term clinical outcomes or costs to be prevented;
- inpatients who were not monitored by an effective telemetry system fared no better than outpatients if cardiac arrest occurred;
- the 30-day survival rate for out-of-hospital cardiac arrest was 0%;
- deaths in the hospital were not preventable; and
- patients could be discharged before any complications arose on day 4 that would cause clinicians to cancel plans for discharge.
Measure of benefits used in the economic analysis
The measure of health benefits used was the number of years of life gained. The benefits were discounted at a rate of 3%.

Direct costs
Only the direct costs to the hospital were included. The unit costs were not presented separately from the quantities of resources used. Hospital resources (derived from the GUSTO-1), physicians' fees (derived from the Medicare fee schedule) and nursing were evaluated. Physician costs and the costs of each additional monitored day in hospital were reported. The costs of discharge were not presented. The costs were discounted at a rate of 3%.

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

Indirect Costs
The indirect costs were not included.

Currency
US dollars ($).

Sensitivity analysis
Several one-way sensitivity analyses were performed. The variables investigated were:

- the incidence of ventricular arrhythmia,
- the success of resuscitation,
- the cost of the fourth day in hospital,
- the cost of care for patients who survived ventricular arrhythmia,
- the incidence of recurrent ischaemic events,
- outpatient care, and
- follow-up calls to patients who were discharged early.

For variables for which empirical estimates were available, the extremes of the 95 percent confidence intervals were used in the sensitivity analyses.

Estimated benefits used in the economic analysis
The discounted life expectancy was 12.3980 in the discharge group and 12.4041 in the prolonging hospital group. On average, an additional 0.006 years of life were gained by keeping patients with no complications in the hospital for a fourth day.

Cost results
The total costs of each alternative were not reported.

The incremental cost of an additional day of hospitalisation was $624.
Synthesis of costs and benefits
Extending the hospital stay by another day would cost $105,629 per year of life saved.

The cost-effectiveness ratio was sensitive to the incidence of ventricular arrhythmia on day 4 ($65,777 and $183,525 for the upper and lower limits of the 95% confidence intervals, respectively). It was also sensitive to the increase in the intensity of services for the additional hospital day ($145,967 for a nurse-to-patient ratio of 1:4 instead of 1:6).

The cost-effectiveness ratio was relatively insensitive to wide variations in the probability of death if ventricular arrhythmia occurred in hospitalised patients, and in the cost of care for patients who survived ventricular arrhythmia.

A final sensitivity analysis showed that the cost-effectiveness ratio ranged from $103,636 to $82,712 per year of life saved, depending on the intensity, type and frequency of extra follow-up care for early discharged patients.

Authors' conclusions
In relation to other medical interventions, extending hospitalisation beyond 72 hours after thrombolysis for patients with uncomplicated myocardial infarction (MI) is not cost-effective.

CRD COMMENTARY - Selection of comparators
The reason for the choice of the comparator (discharge at 72 hours) was clear. You should consider whether this is a widely used technology in your own setting.

Validity of estimate of measure of effectiveness
The measure of effectiveness was derived from one study, which was a randomised trial. Few details of the clinical study were reported. Hence, it was not possible to assess the internal validity of the trial from this paper.

Validity of estimate of measure of benefit
The authors constructed a decision model to estimate the number of life-years gained by prolonging hospitalisation after 72 hours. The decision analysis model used was appropriate, even though the authors made several model assumptions. The method used to derive the life expectancy was also appropriate.

Validity of estimate of costs
The perspective adopted in the study was unclear. However, only the health service costs were included. The resource quantities and the costs were not reported separately and no details of the cost items included in the analysis were given. This means that the analysis could not be reworked for other settings. No statistical analysis of the quantities was reported. However, sensitivity analyses were conducted on the costs. The source of the cost data was reported. Discounting was appropriately undertaken.

Other issues
The generalisability of the results was not discussed, although the authors made appropriate comparisons of their findings with those from other studies. The authors highlighted some limitations of their study, which have been mentioned already. The authors do not appear to have reported their results selectively. The reproducibility of the results to other settings may be questionable in terms of the cost estimates.

Implications of the study
The authors recommended the continuous quality control and long-term follow-up of early-discharge plans to ensure that short-term gains (in reduced costs due to shorter hospitalisation) do not occur at the expense of long-term outcomes.
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Other publications of related interest


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