Cost-effectiveness of a coronary care unit versus an intermediate care unit for emergency department patients with chest pain

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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
Coronary care unit versus intermediate care unit for emergency department patients with chest pain.

Type of intervention
Treatment.

Economic study type
Cost-effectiveness analysis.

Study population
A hypothetical cohort of emergency department patients with acute chest pain (presenting with suspected myocardial infarction).

Setting
The setting was a hospital in the USA.

Dates to which data relate
Effectiveness data relate to 1984-6 The resource use data were derived from a study published in 1992. 1992 prices were used.

Source of effectiveness data
Effectiveness data was derived from a single study, the Multicenter Chest Pain Study.

Link between effectiveness and cost data
Costing was undertaken on a different patient sample from that used in the effectiveness study.

Study sample
Of 14,832 eligible patients, 12,139 participated in the trial. 2,140 patients did not consent to participate. 434 patients were excluded because the follow up was inadequate. Another 119 patients were excluded because of missing essential data. Patients were aged 30 years or older. No power calculations were reported.

Study design
Prospective cohort study. The duration of follow-up was until hospital discharge. The study was conducted in seven different hospitals.
Analysis of effectiveness
The analysis of effectiveness was based on treatment completers only. The health outcome measured in the study was survival gain within 48 hours associated with initial triage to the coronary care unit (CCU) rather than the intermediate care unit for patients with acute myocardial infarction (AMI). Estimates of 48 hour mortality, complications rate for patients with and without AMI were also reported.

Effectiveness results
Of 1603 patients with acute myocardial infarction, admitted to the coronary care unit, 90 patients (5.6 %) died within 48 hours of admission.

The estimated 48 hours mortality rates were:

- patients aged 30-44, 3.1% (95% CI: 1.4% - 6.8%);
- patients aged 45-54, 2.8% (95% CI: 1.5% - 5.3%);
- patients aged 55-64, 4.6% (95% CI: 7.0% - 12.9%);
- patients aged 65-74, 6.8% (95% CI: 4.9% - 9.5%);
- patients aged over 75, 9.5% (95% CI: 7.0% - 12.9%).

The probability of death of patients with acute myocardial infarction might be 15% greater if they were admitted to the intermediate care unit instead of the coronary care unit within 48 hours. The mortality for patients without myocardial infarction was estimated to be 0.1% (95% CI: 0.03% - 1.4%). This estimate was the same regardless of age and type of care (intermediate care unit or CCU).

Modelling
A decision model was used to estimate expected costs and life-years remaining for patients admitted to coronary care unit and intermediate care unit. A logistic regression model was used to estimate the age-specific probabilities of mortality from acute myocardial infarction within 48 hours among patients admitted to the coronary care unit.

Measure of benefits used in the economic analysis
The measure of benefits used in the economic analysis was life-years gained, estimated using a model incorporating epidemiological data (life tables and cohort data) from a US study.

Direct costs
Costs were discounted at the rate of 5% per year. Quantities and costs were not analysed separately. The latter included hospital costs, which were derived by applying institution specific cost to charge ratios to actual charge data for patients admitted to one teaching hospital in Boston, MA, USA. After normalising charges to 1986 dollars, costs in 1992 prices were obtaining by applying the general medical care component of the consumer price index. By using hospital length of stay as a proxy of resource utilization, median total cost figures were applied to each patient outcome according to survival status, AMI status, initial triage location, and worst level of complication regardless of age (median total costs for patients with any complications were assumed to be the same regardless of type of care).

Currency
US dollars ($).

Sensitivity analysis
One-way sensitivity analysis was carried out on the probability of mortality of AMI patients admitted to the intermediate care unit and the CCU, median costs, additional resource costs for patients with myocardial infarctions discharged from the hospital, and post-discharge life expectancies for patients with and without myocardial infarction. Also, a threshold analysis was used to present the study results.

**Estimated benefits used in the economic analysis**
Not stated.

**Cost results**
Not stated.

**Synthesis of costs and benefits**
For 55 to 64 years old patients with an emergency department probability of infarction of 1% (on the basis of emergency department clinical data analysed using multivariate algorithms to predict risk), the cost per year-of-life-saved (at 1992 prices and using a 5% annual discount rate for costs and benefits) was $1.4 million, but when the probability of infarction was 99%, the corresponding figure was $15000. For patients 55 to 64 years old, the costs per additional year-of-life-saved was less than $100,000 if the probability for acute myocardial infarction was more than 15%, less than $75,000 if the probability of myocardial infarction was more than 20%, and less than $50,000 if the probability of infarction exceeded 29%. The coronary care unit has a cost-effectiveness comparable to other medical interventions (less than $50,000 per year-of-life-saved) when the initial probability of acute myocardial infarction was greater than 57% among patients 30 to 44 years of age. This threshold probability for acute myocardial infarction dropped to 21% among patients aged 65 to 74 years. If the intermediate care unit is associated with half of the baseline estimate for the relative increase in mortality for patients with acute myocardial infarction (7.5% instead of 15%), the threshold probability of acute myocardial infarction at which the cost per year-of-life-saved for coronary care unit fell below $50,000 increased to approximately twice the baseline estimate.

**Authors’ conclusions**
The study results indicate that the coronary care unit usually should be reserved for patients with a moderate probability of AMI (21% or more, depending on patient's age) unless patients need intensive care for other reasons. Clinical data suggest that only patients with ECG changes of ischaemia or infarction not known to be old have a probability of AMI this high.

**CRD COMMENTARY - Selection of comparators**
The comparator used (intermediate care unit) in the study is relevant given the reported difficulty in excluding with certainty the diagnosis of acute myocardial infarction (AMI) on the basis of data available during the emergency department evaluation.

**Validity of estimate of measure of benefit**
The validity of the effectiveness results is questionable given the potential biases associated with the lack of randomisation in the study design.

**Validity of estimate of costs**
Information regarding quantities of resource use was not reported, which makes it difficult to address the issue of the generalisability of study results.

**Other issues**
The sensitivity analysis investigated the parameters of uncertainty, although it did not consider the effect of the
variation in the estimate of survival benefit from CCU in patients with ACU.

Implications of the study
This study suggests thresholds in risk of AMI that can be used to determine which emergency patients with chest pain should be triaged to CCUs rather than intermediate care units so as make cost-effective use of hospital resource. However, further analysis of the data is desirable in order to give a clear idea of how robust the conclusions are.

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