Outcome of emergency department patients with delayed admission to an intensive care unit

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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
Delayed (up to 24 hours) versus immediate admission to intensive care unit (ICU) was examined for patients presenting at the emergency department (ED).

Type of intervention
Treatment.

Economic study type
Cost-effectiveness analysis.

Study population
The study population comprised adult patients presenting to the ED and requiring ICU admission. Patients aged less than 16 years were excluded, as were patients with documented "do not resuscitate" orders, inter-hospital transfers, and patients requiring emergency surgery and postoperative intensive care. Also excluded were survivors of pre-hospital cardiorespiratory arrest requiring endotracheal intubation, and patients with a known ED diagnosis of drug overdose.

Setting
The setting was secondary care. The economic study was carried out in Australia.

Dates to which data relate
The effectiveness and resource use data were gathered from July 1996 to December 1997. The price year was not reported.

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

Link between effectiveness and cost data
The costing was carried out retrospectively on the same sample of patients as that used in the effectiveness study.

Study sample
The use of power calculations was not reported. The participants were identified from a chart review of ED patients admitted to the ICU during the study period. A total of 122 patients was identified. Of these, 99 patients admitted to the ICU directly from the ED were included in the immediate admission group. The remaining 23 patients, who were admitted to the ICU within 24 hours of admission to a ward or coronary care unit from the ED, formed the delayed admission group.
Study design
This was a retrospective cohort study that was carried out in a single centre, the Box Hill Hospital in Melbourne (Victoria), Australia. The patients were followed up for 30 days or until death. No loss to follow-up occurred since the patients had been identified from hospital records.

Analysis of effectiveness
It appears that all the patients included in the initial study sample have been accounted for in the analysis of effectiveness. The primary health outcomes were 30-day mortality and length of stay (LOS). Survival was calculated using the Kaplan-Meier approach and differences between the groups were estimated using Cox’s proportional hazards regression. Baseline comparability between the groups was based not only on the patients’ demographic and clinical characteristics, but also on the admission mortality probability model (MPM0). The MPM0 was used to evaluate the baseline severity of illness in the ED.

Some baseline differences between the two groups were observed. For example, patients in the direct admission group were younger, more likely to have tachycardia, less likely to have a history of respiratory, cardiac and/or gastrointestinal disease, and less likely to have arterial desaturation than patients in the delayed admission group. The baseline risk of death calculated from the MPM0 was similar for the two groups. However, ED triage categorisation and ED staff seniority were different. Patients in the delayed admission group were more likely to be triaged in less urgent categories and to be initially assessed by junior staff. Finally, patients in the delayed admission group were generally sicker at the time of ICU admission, and there was a higher number of delayed admission patients who were admitted to the ICU after a cardiac arrest.

Effectiveness results
The 30-day mortality was 35% in the delayed admission group and 14% in the immediate admission group, (p=0.044).

The relative risk (RR) was 2.46 (95% confidence interval, CI: 1.2 - 5.2). This was associated with decreased survival (hazard ratio 0.23, 95% CI: 0.10 - 0.53).

Mortality in the ICU was 35% in the delayed admission group and 9.1% in the immediate admission group, (p=0.007). The RR was 3.45 (95% CI: 1.5 - 7.8).

The mean LOS in the ICU was 4.7 (+/- 9.4) days (median 1.4; range: 0 - 38) in the delayed admission group and 3.6 (+/- 5.8) days (median 1.7; range: 0.1 - 34) in the immediate admission group, (p=0.98).

The mean LOS in the hospital was 11.3 (+/- 10) days (median 8; range: 0.7 - 39) in the delayed admission group and 8.7 (+/- 8.6) days (median 6.3; range: 0.2 - 44) in the immediate admission group, (p=0.19).

Clinical conclusions
The effectiveness study showed that delayed admission was associated with higher mortality than immediate admission for patients presenting to the ED.

Measure of benefits used in the economic analysis
The health outcomes were left disaggregated and no summary benefit measure was used in the economic study. Therefore, in effect, a cost-consequences analysis was conducted.

Direct costs
Discounting was not relevant since the costs per patient were incurred during a short time. The unit costs and the quantities of resources used were not presented separately. The health services included in the economic evaluation were:
length of hospital stay (administration, catering, facility and corporate),
bed-days within the ward (coronary care unit, ward consumables and labour),
interventions performed (dietician, occupational therapy, physiotherapy),
tests performed or items dispensed (pathology, radiology, pharmacy),
time and/or service performed in the department (emergency, theatre, ICU), and
issues invoiced by a third party (Visiting Medical Officer).

The cost/resource boundary of the hospital appears to have been adopted. Resource consumption was estimated using actual data derived from the charts of the same patients as those included in the effectiveness study. The costs were estimated from the hospital finance department. The price year was not reported.

**Statistical analysis of costs**
The costs were presented as median values and ranges. Statistical analyses of the costs were conducted to test the significance of differences in costs between the groups.

**Indirect Costs**
The indirect costs were not considered.

**Currency**
Australian dollars (Aus$).

**Sensitivity analysis**
Sensitivity analyses were not performed.

**Estimated benefits used in the economic analysis**
See the 'Effectiveness Results' section.

**Cost results**
The median ICU costs were Aus$1,280 (range: 100 - 20,300) in the direct admission group and Aus$1,080 (range: 30 - 26,400) in the delayed admission group, (p=0.71).

The median total hospital costs were Aus$6,120 (range: 750 - 65,300) in the direct admission group and Aus$5,690 (range: 670 - 80,000) in the delayed admission group, (p=0.64).

**Synthesis of costs and benefits**
The costs and benefits were not combined as a cost-consequences analysis was carried out.

**Authors’ conclusions**
Delayed admission to the intensive care unit (ICU) for patients presenting at the emergency department (ED) led to higher mortality in comparison with patients directly admitted to the ICU. The costs and length of stay (LOS) were not significantly different.
CRD COMMENTARY - Selection of comparators
The choice of the comparators appears to have been appropriate, as both interventions under evaluation reflected standard patterns of ICU admission for patients presenting at the ED. You should decide whether they are valid comparators in your own setting.

Validity of estimate of measure of effectiveness
The effectiveness evidence came from a retrospective study that, as the authors noted, suffered from errors of documentation and accuracy. Further, selection bias could have affected the results of the analysis. The use of a prospective randomised study would have been more appropriate. The study groups were significantly different at baseline and the authors used a validated model (the MPM0) to assess the impact of illness severity on mortality while reducing the potential impact of confounding factors. However, it was unclear whether the model captured all aspects that were different between the groups at baseline. This appears to be a crucial point since the main outcome measure, namely 30-day mortality, was close to the level of statistical non-significance, (p=0.044). The method used to select the sample was unclear, but the study sample was presumably representative of the study population. The authors noted that they were unable to accurately define response to treatment in the ED, an important variable to be considered in decisions about ongoing management. Finally, power calculations were not performed and there was no evidence that the sample size was appropriate. These issues limit the internal validity of the analysis.

Validity of estimate of measure of benefit
No summary benefit measure was used in the study because a cost-consequences analysis was conducted.

Validity of estimate of costs
The authors did not state clearly which perspective was adopted in the study, but it appears to have been that of the hospital. A breakdown of the cost categories was provided, but information on the unit costs and resources used lacking in detail. The price year was not reported, which makes reflation exercises in other settings difficult. The source of cost data was given, but all the estimates were specific to the study setting and no sensitivity analyses were performed. This limits the transferability of the cost estimates. Statistical tests to compare the costs were conducted.

Other issues
The authors did not compare their findings with those from other studies. They also did not address the issue of the generalisability of the study results to other settings. Sensitivity analyses were not carried out, which further reduces the external validity of the study. The analysis referred to adult patients presenting to the ED and requiring ICU admission, and this was reflected in the authors' conclusions.

Implications of the study
The study results suggested "recognition of critical illness in the ED and identification of those at risk of deterioration is crucial for optimization of patient outcome and efficient utilization of scarce health-care resources".

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None stated.

Bibliographic details

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Other publications of related interest

Indexing Status
Subject indexing assigned by NLM

MeSH
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