Cost effectiveness of adult intensive care in the UK
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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 study compared intensive care in adults with non-intensive care treatment.

Type of intervention
Treatment.

Economic study type
Cost-utility analysis.

Study population
The study population comprised a hypothetical cohort of adult patients admitted to general intensive care units (ICUs).

Setting
The setting was a hospital. The economic study was carried out in the UK.

Dates to which data relate
The effectiveness data were derived from studies published between 1994 and 2006. Much of the resource use data came from sources published in 2006. The price year was 2004.

Source of effectiveness data
The clinical data used in the economic evaluation were hospital mortality with and without intensive care treatment and post-hospital survival. Hospital mortality for intensive care and standard hospital stay were estimated in the form of odds ratios (ORs) and the absolute risk reduction (ARR).

Sources searched to identify primary studies
Data on hospital mortality were derived from four of the 10 studies included in a published systematic review of the literature and subsequent meta-analysis of the data. The clinical estimates were pooled using a random-effects statistical model. These data were augmented with more recent information from three additional studies. Details of the calculation of the OR were extensive and were presented in an appendix. Post-hospital survival came from a cohort of 2,104 patients admitted to the general ICU at a hospital in Glasgow from 1985 to 1992. Residual life expectancy was calculated using official life tables, assuming that, at 5 years after admission, life expectancy for survivors was the same as that for an age- and gender-matched general population.

Methods used to judge relevance and validity, and for extracting data
The primary data were derived from a systematic review of the literature and combined using a meta-analysis approach with random-effects to take account of differences due to between-study variability and chance. A detailed description
of the results of each of these studies was given, together with the pooled estimates.

**Measure of benefits used in the economic analysis**
The summary benefit measure used was the quality-adjusted life-years (QALYs). These were estimated by combining survival data obtained from the literature with quality of life (Qol) values elicited for survivors of critical illness in the UK, as reported in four published studies. These values were derived using the EQ-5D questionnaire. The QALYs were discounted at an annual rate of 3.5%. Expected life expectancy was also calculated but it was not combined with the costs.

**Direct costs**
The analysis of the costs was performed from the viewpoint of the NHS. It included the costs of hospital stay (in ICU or general hospital ward) and the lifetime costs of ICU survivors. The unit costs and the quantities of resources used were presented separately only for hospital costs. Inpatient costs were estimated using NHS reference costs. The length of hospital stay was derived from a database containing over 42,000 ICU patients in 133 participating units between April 2002 and March 2003. The lifetime costs of ICU survivors were approximated using the mean annual health expenditure per capita in the UK. Discounting was relevant, as the lifetime costs were evaluated, and an annual rate of 3.5% was used. The price year was 2004. A budget impact analysis was also performed in which the number of patients treated on adult general ICUs in England and Wales was considered.

**Statistical analysis of costs**
The costs appear to have been treated deterministically in the base-case.

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

**Currency**
UK pounds sterling (£).

**Sensitivity analysis**
A deterministic sensitivity analysis was carried out to assess the robustness of the cost-utility ratios to variations in the following:

- the ARR in hospital mortality associated with intensive care,
- the discounted mean residual life expectancy of survivors,
- the utility weights,
- the cost per day in the ICU,
- the cost per day on the general ward,
- the number of days in the ICU,
- the number of days on the general ward in the ICU and non-ICU groups, and
- the annual long-term health care costs for survivors.

The range of values for mortality rates was derived from the literature. However, the sources of alternative values for the costs and resources used were not reported.
Estimated benefits used in the economic analysis
The additional QALYs associated with intensive care in comparison with non-intensive care were 1.27.

The additional life expectancy per patient treated in an ICU was 1.93, years. This value was obtained by multiplying life expectancy for survivors (11.1 years) by the ARR with the ICU (0.174).

Cost results
The extra costs of intensive care over non-intensive care were 8,902. This was obtained as the sum of the incremental cost of the ICU due to hospital stays (5,710) and the long-term extra costs of the ICU due to a higher percentage of survivors (3,192).

The budget impact analysis showed that the total cost of intensive care in the UK was estimated to be 541 million per annum (0.6% of NHS expenditure).

The total budget impact based on the incremental cost of critical care over and above that for non-critical care, and including long-term care costs, was 719 million (0.8% of total NHS expenditure).

Synthesis of costs and benefits
Incremental cost-utility ratios were calculated in order to combine the costs and benefits of the alternative strategies.

The incremental cost per QALY gained with intensive care in comparison with non-intensive care was 7,010.

The sensitivity analysis showed that the cost-utility ratios were particularly sensitive to changes in the ARR at very low values, although for values above 7.6% (17.4% in the base-case), the incremental cost per QALY was below the threshold of 30,000. Changes in other assumptions did not substantially alter the results of the base-case analysis.

Authors' conclusions
Despite its high daily cost, intensive care for adults was cost-effective in the UK in comparison with non-intensive care.

CRD COMMENTARY - Selection of comparators
The rationale for the choice of the comparators was clear given that they represented the only two possible strategies for the patient population under examination. You should decide whether intensive or non-intensive care are valid comparators in your own setting.

Validity of estimate of measure of effectiveness
The clinical data were derived from published studies, most of which were included in a published systematic review of the literature. The results of recently published studies were also considered in order to include all relevant data. Thus, the selection of the primary sources appears to have been appropriate, while the use of a meta-analysis with random-effects for combining the original estimates ensures that between-study variability was adequately considered. Other data were derived from selectively identified sources, such as official statistics or national databases. The key clinical estimate was mortality reduction with ICU, the impact of which was extensively investigated in the sensitivity analysis.

Validity of estimate of measure of benefit
The estimation of benefits (QALYs) was based on data derived directly from the literature. QoL values were obtained from several published studies, thus limited information on the approach used to elicit them was given. However, the use of the EQ-5D was appropriate and conservative estimates were included in the base-case. The QALYs were appropriately discounted, as recommended by UK guidelines.
Validity of estimate of costs
The analysis of the costs was consistent with the perspective of the NHS. Only two main categories of costs were included and a detailed breakdown of the cost items was not given. The sources of the costs were reported; these represented typical NHS sources. No statistical analyses of the costs were performed, but the impact of using different cost estimates was investigated in the sensitivity analysis. The price year was reported, thus facilitating reflation exercises in other time periods. A budget impact analysis was appropriately carried out.

Other issues
The authors did not make extensive comparisons of their findings with those from other studies, although the results of another study conducted in the UK on neonatal intensive care were reported. Concerning the issue of the generalisability of the study results to other settings, the authors stated that ICU admission policies and mortality outcomes might differ across countries, thus caution will be required if extrapolating the results of the analysis to other settings. The authors noted that a potential limitation of the analysis was that non-ICU patients might have had different characteristics than those admitted to ICU, and this might have affected the mortality data.

Implications of the study
The study results suggest that adult intensive care represents good value for money.

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None stated.

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