The use of risk predictions to identify candidates for intermediate care units: implications for intensive care utilization and cost

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
Predictive logistic equation of risk of active treatment using an acute physiology and chronic health evaluation (APACHE II and III) prognostic system for allocation to an intermediate care unit as opposed to intensive care unit (ICU) by monitoring patients with low risk of requiring life supporting treatment.

Type of intervention
Diagnosis and secondary prevention.

Economic study type
Cost-effectiveness analysis.

Study population
Monitored patients admitted to the ICU (i.e. those who did not have active life-supporting treatments during day 1 of admission).

Setting
Hospital. Among the 40 hospital studies, 63% had residents or one or more accredited graduate medical training programmes and 53% were affiliated with a medical school. The study was carried out in Washington, USA.

Dates to which data relate
The main effectiveness data were derived from a single study conducted between May 1988 and February 1990. Cost and resource data were obtained mainly from 1988-90 sources. The price year was 1991.

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

Link between effectiveness and cost data
The costing was undertaken retrospectively on the same study sample as that used for the effectiveness study.

Study sample
The study sample comprised 17,440 consecutive ICU admissions. The mean age was 59 years, and 48% of patients were 65 years or older. The most common diagnoses for patients who had surgery were peripheral artery bypass graft (7.3%), and laparotomy for gastrointestinal neoplasm (6.9%). For non-operative patients, the most common diagnoses were congestive heart failure (8.8%), drug overdose (6.8%) and upper gastrointestinal bleeding due to ulcer or laceration (6.4%). 8,040 patients received only ICU monitoring and concentrated nursing care on ICU day 1. These
came from 42 ICUs, of which 10% were medical, 19% surgical and 71% mixed medical-surgical. No power calculation was used to determine sample size.

**Study design**
Multicentre prospective cohort study (42 ICUs from 40 hospitals). The duration of the follow-up was 7 days.

**Analysis of effectiveness**
The study was based on intention to treat. The primary health outcomes used were active treatment or diagnosis received during the entire ICU stay. With respect to diagnosis, the outcomes used were sensitivity, specificity and false positive prediction, in addition to variation in risk of active treatment accounted for by the equation (using the area under a receiver operating characteristic (ROC) curve).

**Effectiveness results**
The logistic equation using APACHE III predicted a greater number of low-risk monitor patients than the same equation using APACHE II, 7,242 versus 6,180. The sensitivity figures were 90.8% versus 79.4%, and the specificity results were 19% and 55%, respectively. For false positive prediction, the result was 4.4% versus 6.8%, respectively. The ROC area was determined to be 0.74 versus 0.67, respectively.

**Clinical conclusions**
Objective predictions can accurately identify groups of ICU admissions who are at a low risk for receiving life support.

**Modelling**
In order to estimate the risk of active treatment during all the ICU stay a multivariate model was used.

**Measure of benefits used in the economic analysis**
No single benefit measure was derived and, as such, the benefits are assumed to be equal to the effectiveness measures.

**Direct costs**
Capital and operating costs were measured. The quantity/cost boundary adopted was the hospital. Discounting was not required because of the short period of follow-up. Quantities (measured by Therapeutic Intervention Scoring System, TIISS) and costs were reported separately. Resources used were measured for the period 1989-94. The price date was 1991.

**Currency**
US dollars ($).

**Estimated benefits used in the economic analysis**
The logistic equation using APACHE III predicted a greater number of low-risk monitor patients than the same equation using APACHE II, 7,242 versus 6,180. The sensitivity figures were 90.8% versus 79.4%, and the specificity results were 19% and 55%, respectively. For false positive prediction, the result was 4.4% versus 6.8%, respectively. The ROC area was determined to be 0.74 versus 0.67, respectively.

**Cost results**
Low-risk patient accounted for $64.3 million (15%) of the $417.5 million estimated cost of caring for all 17,440 of the ICU admissions during the first 7 days at ICU.
Synthesis of costs and benefits
Costs and benefits were not combined.

Authors' conclusions
Objective predictions can accurately identify groups of ICU admissions who are at a low risk for receiving life-support. This capability can be used to assess ICU resource use and develop strategies for providing graded critical care services at a reduced cost.

CRD COMMENTARY - Selection of comparators
The reason for the choice of comparator is clear. Intermediate care units may decrease costs, improve ICU utilization, avoid ICU readmission and decrease mortality rate in hospital wards. You, as a user of this database, should consider whether this is a widely used health technologies in your setting.

Validity of estimate of measure of benefit
The estimate of measure of benefit used in the economic analysis is likely to be internally valid. The data have not been used selectively.

Validity of estimate of costs
Resource quantities were reported separately from the prices and adequate details of methods of quantity/cost estimation were given. Important cost items do not appear to have been omitted. However, as noted by authors, the cost saving estimates would probably vary widely among hospitals since construction cost, improved ICU occupancy and the extent of cost shifting would depend on specific institutional circumstances.

Other issues
The authors' conclusions are likely to be justified given the uncertainties in the data. The issue of generalisability to other countries was addressed in that other countries have fewer monitor admissions and therefore less opportunity to reduce their proportion. Appropriate comparisons were made with other studies in relation to ICU admissions and improvement of ICU utilization. Results do not appear to have been presented selectively. However, a synthesis of developed benefits and costs could have been adopted as a summary cost-effectiveness analysis.

Implications of the study
Further analysis is required into the use of predictions of risk for active treatment to assist ICU admission decisions or be applied to individual patients. Furthermore, more research is required into the potential prevention of adverse events from ICU care or to demonstrate the efficacy of intermediate care.

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