Trauma-specific intensive care units can be cost effective and contribute to reduced hospital length of stay


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
A "closed" trauma intensive care unit (TICU), managed by surgeons with added qualifications in surgical critical care and staffed by highly trained nurses and ancillary personnel, was studied. The TICU consisted of 12 beds separated by permanent door to ceiling partitions (6 of them fully enclosed with individual entry doors), each room having a sink. Full details of the TICU were reported in the paper.

Type of intervention
Treatment and organisation.

Economic study type
Cost-effectiveness analysis.

Study population
The study population comprised trauma patients admitted to a SICU or TICU without major brain injury (multiple injuries, high-grade solid organ injury, major trauma-related operations, and spinal cord injuries). The patients had to have an injury severity score of 15 or greater upon admission, and a LOS at the ICU of at least one day. Patients admitted purely for monitoring purposes or transferred from a general trauma floor were excluded.

Setting
The setting was tertiary care. The economic study was undertaken in a university affiliated hospital with a state-verified Level I trauma centre in Birmingham (AL), USA.

Dates to which data relate
The effectiveness and resource use data were collected from 1 June 1996 to 1 July 1997. The price year was not reported.

Source of effectiveness data
The effectiveness data were 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 analysis.

Study sample
Power calculations and sample size justifications were not reported. The sample was selected from consecutively admitted patients. The authors justified their selection of the patient sample, excluding a sub-group of patients with
expected high and low resource use. The study included 204 trauma patients. Of these, 114 were treated in the SICU between 1 June 1996 and 4 January 1998, and 60 were treated in the TICU between 5 January 1998 and 1 July 1998.

**Study design**
The authors reported the design as a cross-sectional study through a retrospective chart review. However, it could be classified as a single-centre retrospective comparative study with historical controls (SICU). Follow-up was until death or discharge. Blinding of the chart reviewer(s) was not reported.

**Analysis of effectiveness**
The analysis of clinical data was conducted on the basis of treatment completers only. The main outcome measures were changes in LOS and number of ventilator days, prevalence of complications, and changes in patient charges. SICU- and TICU-treated patients differed in some baseline characteristics such as age (TICU patients were 3.7 years older, p=0.06). To evaluate mortality, adjustments were made for age and injury severity.

**Effectiveness results**
The crude and adjusted mortality rates were similar between the TICU and SICU. The crude mortality rate was 4.9% in the TICU group versus 4.6% in the SICU group, (p non significant), while the adjusted mortality rates were 5.0% (TICU) and 8.0% (SICU), respectively, (p non significant).

Patients in the TICU tended to have a shorter ICU LOS (9.4 days) than those in the SICU (12.1 days), (p=0.06). They also had a significantly shorter hospital LOS (15.6 versus 22.3 days; p=0.01).

Some injury and clinical characteristics favoured the TICU group. In particular, lower ventilator hours (83.1 versus 100; p=0.007), lower prevalence of cardiovascular (21.3% versus 39%; p=0.01) and renal failure (1.6% versus 12.3%, p=0.02), and a trend towards having a lower proportion of patients with infections.

**Clinical conclusions**
The authors concluded that TICU patients had similar mortality to SICU patients, but had a lower number of ventilator hours and complications. They also had lower ICU and overall hospital LOS than SICU patients.

**Measure of benefits used in the economic analysis**
The authors did not derive a summary measure of benefit. In effect, a cost-consequences analysis was conducted.

**Direct costs**
The perspective appears to have been that of the hospital. The authors reported charges and total costs, which included overheads and bad debt. The charges and costs were based on a cost-accounting software system (Transitions Systems, Inc. Boston) in use at the University Hospital and were obtained from the Hospital Business Office. The quantities and the costs were not analysed separately and were based on actual patient aggregate charges and costs. Discounting was unnecessary as the study had a short time horizon. The price year was not reported.

**Statistical analysis of costs**
The costs were treated stochastically and, as they had a skewed distribution, the mean and median values were reported. The median values were compared using a non-parametric Kruskal Wallis test.

**Indirect Costs**
This cost category was not included.
Currency
US dollars ($).

Sensitivity analysis
No sensitivity analysis was performed.

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

Cost results
The mean hospital charge was $125,383 for TICU patients compared with $152,944 for SICU patients, (p=0.06).

The comparison of median hospital charges showed TICU patients having significantly lower median charges ($86,520) than SICU patients ($120,764), (p=0.02).

There was a tendency for TICU patients to have lower average and median costs (direct and overall) than SICU patients, but none of these comparisons achieved statistical significance.

To determine the overall cost-savings resulting from the implementation of the TICU, the characteristics of the trauma patients (e.g. age, LOS, and ISS) treated in the TICU were matched to those treated in the SICU. The cost of care of SICU patients was then applied to the TICU patients and subtracted from the actual cost of the TICU patients. These differences were then summed across all TICU patients. The sum ($314,520) represents an estimate of the net cost-savings during the first 6 months' operation of the TICU.

Synthesis of costs and benefits
The costs and benefits were not combined.

Authors' conclusions
This study suggests that, during the initial 6 months' operation of a specialised trauma intensive care unit (TICU), the clinical outcomes are improved compared with care received in the surgical intensive care unit (SICU), and the costs and length of stay (LOS) are decreased.

CRD COMMENTARY - Selection of comparators
The choice of the comparator was explicitly justified. It probably represents current practice in most settings where there is no special ICU for trauma patients.

Validity of estimate of measure of effectiveness
The analysis was based on a non-randomised retrospective chart review of outcomes of two systems of care for trauma patients, using SICU as an historical control. Although this type of design is subject to inherent biases (comparability of groups, changes in time not related to the specific intervention) and confounders, the authors stated that there were no studies on the specific topic. It was not stated whether the reviewer(s) was blinded, which would reduce outcome assessment bias. The patient groups were broadly comparable at baseline and age differences were accounted for in the analysis. Although the authors justified the exclusion of some patients, owing to them having lower expected complications (which would hinder comparisons) or higher expected complications (which would mean a few cases would have had a disproportionate cost contribution), this limits the external validity of the findings. Sample size calculations were not reported. Thus, non statistically significant but clinically relevant findings might have resulted from a lack of power to detect them.
Validity of estimate of measure of benefit
No summary measure of benefit was derived. In effect, a cost-consequences analysis was conducted.

Validity of estimate of costs
The cost perspective was not explicitly stated, but it appears to have been that of the hospital. Several aggregate charge and cost measures were reported, based on the hospital bill. However, neither the categories of costs included, nor the unit costs, were described in detail. The quantities and the costs were not analysed separately, and the price year was not reported. All of these factors limit transferability exercises to other settings and times. Although the total costs were treated stochastically, there is no way to determine in which cost category the differences lie, or to determine the main cost drivers. The costs of implementing the new strategy (TICU) do not appear to have been included, although the authors calculated that the capital outlay needed for a TICU would be recovered in slightly more than 2 years (details of this calculation were not reported).

Other issues
The authors stated that they found no study on the subject, although they did report other studies related to "closed" units and good outcomes that were in line with their results. The issue of generalisability to other settings was not addressed and may be limited by the aforementioned factors.

Implications of the study
Others studies showed that critical care errors represent an important cause of death in trauma patients. This retrospective comparative study with historical control is the first, to the authors’ knowledge, to compare SICU and TICU results. In addition, it supported the notion that a specialised ICU for trauma patients could be cost-effective by contributing to decreased ICU and hospital LOS, while maintaining a high level of care. Data from randomised controlled trials would be needed to evaluate the true clinical and cost effects of such alternative care strategies.

Source of funding
None stated.

Bibliographic details

PubMedID
11450785

Indexing Status
Subject indexing assigned by NLM

MeSH
Adult; Cost Savings; Cost-Benefit Analysis; Hospital Charges; Humans; Intensive Care Units /economics; Length of Stay; Retrospective Studies; Survival Rate; Trauma Centers /economics; Wounds and Injuries /complications /economics /mortality /therapy

AccessionNumber
22001001380

Date bibliographic record published
28/02/2005

Date abstract record published