Effect of an education program on decreasing catheter-related bloodstream infections in the surgical intensive care unit


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
An education programme directed at registered nurses, to promote correct practice for central venous catheter (CVC) insertion and maintenance for patients admitted to surgical intensive care units (ICUs), was examined. The programme, which was developed by a multidisciplinary team, consisted of a 10-page self-study module on catheter-related bloodstream infections (CRBIs) and a verbal in-service element at staff meetings. The study module on CRBIs covered epidemiology and scope of the problem, risk factors, etiology, definition, and methods to decrease the risk.

Type of intervention
Educational programme.

Economic study type
Cost-effectiveness analysis.

Study population
The study population comprised patients admitted to a surgical, burn or trauma ICU.

Setting
The setting was secondary care. The economic study was carried out at the Barnes-Jewish Hospital (a university-affiliated teaching institution), St. Louis (MO), USA.

Dates to which data relate
The effectiveness data were gathered from January 1998 to June 1999 in the pre-intervention group, and from July 1999 to December 2000 in the post-intervention group. 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 performed on a sample of patients that was different from that used in the effectiveness study.

Study sample
Power calculations to determine the sample size were not conducted. All eligible patients admitted to the ICU between January 1998 and June 1999 were enrolled in the pre-intervention group. All eligible patients admitted to the ICU between July 1999 and December 2000 were enrolled in the post-intervention group. There were 2,188 patients in the pre-intervention group and 2,095 patients in the post-intervention group. Consecutive patients were considered, thus no
patients should have been excluded from the initial study for any reason.

**Study design**
This was a pre- and post-intervention, observational study, which was conducted in a single centre. The patients in the two study groups were enrolled in two different timeframes. However, the authors stated that the nurse and technician staffing patterns were similar throughout the length of the study. The length of follow-up was not reported and it appears that no loss to follow-up occurred.

**Analysis of effectiveness**
All of the patients included in the study sample were taken into account when estimating the effectiveness outcomes. The outcomes used in the analysis were the number of CRBIs observed in the two study periods and the results of a 20-question exam, which tested the knowledge of catheter-related bacteraemia before and after the education programme was implemented. The authors stated that the study groups were comparable at baseline in terms of their demographics and ICU characteristics.

**Effectiveness results**
There were 74 CRBIs in 6,874 CVC days (infection rate of 10.8 per 1,000 CVC days) in the pre-intervention period and 26 CRBIs in 7,044 CVC days (infection rate of 3.7 per 1,000 CVC days) post-intervention. This variation represented a decrease of 66% and was statistically significant, (p<0.0001).

Fifty-two staff members completed the education module. The average correct score was 78.3% (+/- 12.9) on the pre-intervention test and 89.9% (+/- 8.3) on the post-intervention test, (p<0.0001).

**Clinical conclusions**
The effectiveness study showed that the education programme was effective in reducing the infection rate.

**Measure of benefits used in the economic analysis**
The health outcomes were left disaggregated and no summary benefit measure was used. A cost-consequences analysis was therefore conducted.

**Direct costs**
Discounting was not relevant because the costs per patient were incurred during a short time. The economic analysis included the total hospital cost of a CRBI. This cost was estimated from published studies (see Other Publications of Related Interest) and ranged from $3,700 to $56,167. A breakdown of the costs was not provided. The number of infections avoided (representing the resources saved with the new protocol) was derived from the estimates observed in the effectiveness study. The price year was not reported. This would have been relevant since the costs were estimated from studies published in different years.

**Statistical analysis of costs**
No statistical tests were conducted on the costs.

**Indirect Costs**
The indirect costs do not appear to have been included.

**Currency**
US dollars ($).
Sensitivity analysis
Sensitivity analyses were not performed.

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

Cost results
As 50 infections were avoided over the study period, the cost-savings associated with the education programme ranged from $185,000 to $2.808 million.

Synthesis of costs and benefits
A synthesis of the costs and benefits was not relevant because a cost-consequences analysis was performed.

Authors’ conclusions
An education programme aimed at promoting correct practice for central venous catheter (CVC) insertion and maintenance for patients admitted to surgical intensive care units (ICUs) was effective in reducing the rate of acquired infections and costs relative to the earlier model of care.

CRD COMMENTARY - Selection of comparators
The rationale for the choice of the comparator was clear. The care protocol used before the implementation of the education programme was selected as the basic comparator because it represented the standard approach. You should decide whether it represents a valid comparator in your own setting.

Validity of estimate of measure of effectiveness
The analysis of effectiveness used a pre- and post-intervention observational study. This was carried out to compare the outcomes associated with the study intervention in two timeframes. The evidence was gathered prospectively in both periods. The analysis had several strengths. For example, the baseline comparability of the study groups and the large sample size (although power calculations were not conducted). Also, the selection of consecutive patients, and the similarity of care patterns over the overall study period. Overall, the study sample appears to have been representative of the study population.

There were, however, some limitations of the analysis. First, the lack of random allocation of the patients to the study groups could have resulted in confounding factors affecting the estimated outcomes. Second, the outcome assessment was not blinded and the staff were aware of the study intervention, thus more careful and intense care may have been provided in the post-intervention period. Third, given that the outcomes were estimated in two different periods, some factors other than the study programme may have had an impact on the results of the effectiveness analysis. The authors noted that, due to the complexity of the intervention, it was unclear whether the reduced infection rate was the result of the education programme or it was affected by the interaction of several factors. These issues tend to limit the internal validity of the analysis.

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

Validity of estimate of costs
The perspective adopted in the study was not stated, although it appears that only the costs relevant to the hospital have been considered. Few details of the cost analysis were reported, as the total costs associated with an episode of infection
were estimated from published studies. The use of such data appears to have been problematic, because the costs referred to different years and it was not stated whether or not the cost categories considered in each study were comparable. Consequently, a very wide range of cost-savings was observed. A further limitation to the validity of the cost analysis was that the intervention costs were not evaluated, and these should have some (albeit minimal) economic impact on the resources of the hospital (e.g. time spent by nursing staff or other personnel to learn and implement the new care protocol. Thus, the final figures reflected a range of cost-savings that did not refer to a specific price year or determined categories of costs. The results of the economic evaluation should, therefore, be interpreted with caution.

**Other issues**

With the exception of the cost results, the authors did not compare their findings with those from other published studies. The issue of the generalisability of the study results to other settings was not addressed and sensitivity analyses were not conducted. Thus, the external validity of the analysis was low. The authors noted some strengths and drawbacks of their analysis, which have been reported already. The issue of the use of antibiotic-impregnated catheters was discussed. The authors stressed that their use would result in higher costs despite a small reduction in the number of CRBIs.

**Implications of the study**

The study results suggested that registered nurses may safely, successfully, and efficiently implement an education programme to reduce infection rates in ICU patients. The authors stressed the need for an environment in which collaboration between health care professionals may lead to benefits to patients and hospital budgets. Further physician-directed education initiatives should help clarify the potential benefits of a physician-based education programme.

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**Bibliographic details**


**PubMedID**

11902288

**Other publications of related interest**


Arnow PM, Quimosing EM, Beach M. Consequences of intravascular catheter sepsis. Clinical Infectious Diseases 1993;16:778-84.

**Indexing Status**

Subject indexing assigned by NLM

**MeSH**

Catheterization, Central Venous /adverse effects; Education, Medical, Continuing /methods; Education, Nursing, Continuing /methods; Humans; Intensive Care Units /manpower; Sepsis /etiology /prevention & control

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