Do protective devices prevent needlestick injuries among health workers?

Orenstein R, Reynolds L, Karabaic M, Lamb A, Markowitz S M, Wong E S

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
Using protective devices (shielded 3 ml safety syringe and the components of a needleless IV system) in the prevention of needle stick injuries (NSIs) in health care workers (HCW).

Type of intervention
Primary prevention.

Economic study type
Cost-effectiveness analysis.

Study population
Health care workers, ranging from nursing students, nurses aides, licensed nurses through medical students to attending and resident physicians.

Setting
Hospital and primary care. The economic study was carried out in Virginia, USA.

Dates to which data relate
The data for the effectiveness study and resource use were collected from 14 January 1992 to 14 January 1993. The prices used were those prevailing in 1992.

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 patient sample as that used in the effectiveness analysis.

Study sample
No power calculations were reported. The study population consisted of 262 nursing personnel and house staff teams (attending and resident physicians, interns and medical students). There were 5 participant units: three general medical units, two surgical units and a 15-bed surgical-trauma intensive care unit (ICU). The intervention was carried out in four of the five general study units and in the surgical trauma ICU. The control was applied during the first six month period of the study and to one of the general study units in the remaining 6 months of the study.

Study design
A prospective controlled before-and-after study was used, with the after period having one control unit determined by randomisation among the five general study units (the general medical units and the surgical units). The study was carried out in a single centre. The duration of the study was 12 months after the intervention (a before period of 6 months and an after period also of 6 months). No loss to follow-up was reported. The groups were controlled for patient acuity, number of HCW-days and reporting methods.

**Analysis of effectiveness**

The analysis was based on the 'intention to treat' principle. The primary health outcome used was occurrence of NSIs. The HCW were asked about preferences between standard devices and the new protective devices, by means of a questionnaire applied at 1 and 3 months after the initiation of intervention. The study units were reported as comparable (before and after the intervention) in terms of patient census, acuity level, and staffing. The analysis controlled for patient acuity, number of HCW-days and reporting methods. The analysis was also carried out by categories of occurrence in terms of NSI site, procedure performed and type of personnel injured.

**Effectiveness results**

There were 33 NSIs before the intervention and 14 after representing a reduction of 61% after the intervention (0.785 'before' to 0.303 'after' NSIs per 1000 HCW-days, \( p=0.046 \)). 7 of the 33 NSIs occurring before the intervention and 1 of the 14 NSIs after, were from the control unit. Furthermore, preventable NSIs decreased from 18 to 8, whereas non-preventable NSIs decreased from 15 to 6. When analysed by procedure performed, the results yielded a 50% reduction in all categories with \( p \) values well above 0.05. The authors reported "no significant differences in NSI rates" between the control unit and the intervention units with respect to intravenous line-related, 3 ml syringe-related, and total NSIs. No major difference in preference at 1 and 3 months after the introduction of the intervention was reported. The purchase of the Safety-Lok syringes and Inter-Link needleless intravenous system components was supported by 73% and 94% of those HCW surveyed, respectively.

**Clinical conclusions**

The authors concluded that NSIs, potentially preventable by the use of protective devices, were not significantly decreased compared with the control unit and non-preventable mechanisms of NSI. They argued that the 61% reduction found in NSIs cannot be directly attributed to the protective devices due to the presence of a similar decrease in NSIs which occurred in the control unit.

**Measure of benefits used in the economic analysis**

The number of NSIs was used as the main benefit measure.

**Direct costs**

The quantities of resources used were reported. The cost items were reported separately. The costs measured were the operating costs (device costs) and cost of complications (cost of NSIs). The boundary adopted was the hospital. The estimation of costs and quantities was based on actual data. The source of quantities and unit costs was the "standardized personnel exposure forms" filled in during the clinical study and the computer files from the institution. The quantities of resources used were measured between 14 January, 1992 and 14 January, 1993. The prices used were those of 1992. Costs excluded from the analysis were those arising from liability suit from an occupationally infected HCW, and the cost of "untoward effects of preventive strategies, such as zidovudine postexposure prophylaxis".

**Indirect Costs**

Not reported.

**Currency**

US dollars ($).
Sensitivity analysis
The cost of clinical plus serologic evaluation of the NSI was used as the parameter, taking values reported in the literature. A one-way simple sensitivity analysis was used.

Estimated benefits used in the economic analysis
There were 33 NSIs before the intervention and 14 after.

Cost results
The total cost after the intervention was $26,198 and the total cost before the intervention was $11,024. The incremental cost during the 6-month period after the intervention with respect to the cost during the previous 6 months was $15,178.

Synthesis of costs and benefits
Cost per NSI prevented was calculated as the cost-effectiveness measure with the calculated value being $798 for the intervention relative to the comparator. When the range of 'cost per NSI' values reported in the literature was used the cost-effectiveness ratio ranged from $759 to -$141 per NSI prevented (cost saving with the intervention).

Authors' conclusions
The authors concluded that: "Despite an overall reduction in needle stick injury rates, no statistically significant reductions could be directly attributed to the protective devices. These devices are associated with a significant increase in cost compared with conventional devices. Further studies must be concurrently controlled to establish the effectiveness of these devices".

CRD COMMENTARY - Selection of comparators
The reason for the choice of comparator is clear.

Validity of estimate of measure of effectiveness
The study design chosen (a before-and-after study) may have led to biases. The authors themselves pointed out that the study may not be internally valid, their argument being that:(a) the purpose of the study was to detect overall differences in NSI rates between groups, and that the comparison of the relevant subgroups (preventable NSIs against the remainder) therefore suffered from the low numbers involved, and (b) the study only used the components and not the entire needleless system, which, it was argued, may have led to the 50% compliance rate. On the other hand, the authors pointed out that the study was carried out at a time of increased awareness, on the part of nurses, of the danger of NSI.

Validity of estimate of costs
The resource quantities were reported separately from the prices. The cost analysis did not take into account cost savings from increased product availability, liability suits from infected HCWs or the cost of untoward effects of preventive strategies (such as post-exposure prophylaxis) or indirect costs (lost productivity).

Other issues
Given the lack of randomisation, investigation of the effects of confounding variables, and statistical analysis of the costs, the results need to be treated with some caution. The issue of generalisability was partially addressed (by sensitivity analysis).

Source of funding
Supported in part by a grant from Baxter Healthcare Corporation, Deerfield, Illinois.
Bibliographic details

PubMedID
8821109

Indexing Status
Subject indexing assigned by NLM

MeSH
Direct Service Costs; Female; Hospital Units; Hospitals, University; Humans; Male; Needlestick Injuries /economics /epidemiology /prevention & control; Personnel, Hospital; Prospective Studies; Protective Devices /statistics & numerical data; Risk Factors; Surveys and Questionnaires; Syringes /statistics & numerical data

AccessionNumber
21996000132

Date bibliographic record published
31/07/1999

Date abstract record published
31/07/1999