Introducing safety syringes into a UK dental school: a controlled study

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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 use of safety syringes in a dental school in the UK was studied. Septodont Safety Plus was chosen from among four different types of safety syringes. The other disposable syringes considered, but not chosen, were USA Hyposafety, US ultrasafe and Kavo disposable.

Type of intervention
Primary prevention.

Economic study type
Cost-effectiveness analysis.

Study population
The study population comprised staff from dental practices who were at risk of needle stick injuries. The staff included students, trainees and qualified dentists.

Setting
The setting was primary care (a dental school). The economic study was carried out in London, UK.

Dates to which data relate
The dates to which the effectiveness and cost data related were not reported (correspondence with the author indicates that the study period was July 1995 to 2000 with new syringes being introduced in the summer of 1998. The price year was not stated, but correspondence with the author indicates that it was 2000.

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

Link between effectiveness and cost data
It was not unclear whether the costing was carried out on the same sample population as that used in the effectiveness analysis.

Study sample
No power calculations were performed in the planning phase of the study to assure a certain power. All members of staff working in a dental school who were at risk of needle stick injuries were included in the effectiveness analysis. This included trainees (i.e. dental students, student dental nurses and student therapists/hygienists) and qualified dentists. Two control groups were considered in the clinical analysis. The first comprised staff working in the dental school before the introduction of the safety syringes. The second was a busy surgical unit where an increased awareness
of safety issues was considered sufficient to reduce the risk of injuries occurring during disposal. In the dental school group, there were 68 qualified dentists during the study period and a variable number of trainees, depending on the year of follow-up. There were 173 trainees during year 1, 170 during year 2, 186 during year 3, 176 during year 4, and 176 during year 5. In the surgical unit used as the control group, there were 39 qualified dentists and 20 trainees during the whole study period. The study sample was representative of the study population.

**Study design**

The study was conducted on the basis of two designs (before-and-after and cohort). In the first element, the same dental school group was analysed retrospectively during the 3 years prior to the introduction of the safety syringes, and prospectively for 2 years after. This indicated a before-and-after study. In the second element, a control group using only standard non-disposable syringes was followed up during the same 5 years, and their outcomes were compared with those obtained in the dental school group. This indicated a cohort study, which was retrospective during the 3 years’ follow-up prior to the introduction of the syringes, and prospective for the 2 years after their introduction.

The study appears to have been carried out in a single centre. The authors reported that the staff members in the study sample were unaware that the clinical analysis was being carried out (therefore, blinded to the assessment). No loss to follow-up was reported.

**Analysis of effectiveness**

The analysis was based on all participants for whom data were available. The primary health outcomes used in the effectiveness analysis were the total number of sharp injuries, the number of syringe-related injuries and the number of avoidable injuries. These were reported for each year and both groups. The authors also reported:

- the estimated number of needle contacts per week;
- the frequency of avoidable needle stick injuries per 1 million hours worked;
- the incidence of avoidable needle stick injuries per 1,000 employees in the second year after the introduction of the safety syringes, and for the 3 years prior to their introduction (dental school); and
- the average incidence of avoidable needle stick injuries per 1,000 employees in the 3 years prior to the introduction of the syringes and the 2 years after.

Avoidable needle stick injuries were defined as those that could be prevented, in other words, needle stick injuries that were sustained during re-sheathing and dismantling of the syringes or while the needle was lying uncovered in an operating area. The groups were not shown to be comparable at analysis, although this would have been necessary to make appropriate comparisons between the staff from the dental school and the surgical unit.

**Effectiveness results**

Among qualified dentists (n=68) in the dental school, there was 1 avoidable injury in year 1 and in year 2, 2 in year 3 and in year 4, and 0 in year 5.

Among trainees in the dental school, there were 5 avoidable injuries in year 1 (n=173), 3 in year 2 (n=170) and in year 3 (n=186), 1 in year 4 (n=176), and 0 in year 5 (n=176).

All the injuries reported after the introduction of the safety syringes occurred in the first 6 months after the change.

In the surgery unit, there were 2 avoidable injuries in year 1, 1 in year 2 and in year 3, and 2 in year 4 (both near misses) and in year 5 (1 near miss).

The estimated number of needle contacts per week were 1,640 in the dental school and 270 in the surgical unit.

Within the dental school, the frequencies of avoidable needle stick injuries per 1 million hours worked were 14 (year
1), 8 (year 2), 11 (year 3), 7 (year 4) and 0 (year 5). The corresponding frequencies within the surgical unit were 29 (year 1), 20 (year 2), 29 (year 3), 20 (year 4) and 20 (year 5).

The incidence of avoidable needle stick injuries per 1,000 employees in the dental school was, on average, 2.05% for the 3 years prior to the use of safety syringes, and 0% in the second year after their introduction. Within the surgical unit, this incidence was 4.52% for the 3 years prior to the intervention and 3.39% in the 2 years after.

**Clinical conclusions**

There was a reduction in the number of avoidable needle stick injuries within the dental school staff after the introduction of safety syringes, compared with before their introduction. For the surgical unit, it was not very clear whether it can be considered that the frequency of avoidable needle injuries was reduced in the last two years in comparison with the earlier years.

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

No summary measure of health benefit was used in the economic analysis. The study was therefore categorised as a cost-consequences analysis.

**Direct costs**

The resource quantities and the costs were not reported separately. The direct costs considered in the economic analysis may have been those of the health service, as the costs reported were for the syringes and for treating needle stick injuries in cases where the source patient was either HIV negative or HIV positive. For HIV-negative patients the staff did not require any intervention, whereas for HIV-positive patients the staff may or may not elect for post exposure prophylaxis. In the case of electing post exposure prophylaxis, the costs considered were for administrative and staff costs, a 30-minute consultation and blood tests. The direct costs were obtained from the Central Sterile Supplies Department, Supplies Department and Occupational Medicine. Therefore, the costs were estimated from actual data. Discounting was not performed, but it may not have been relevant since the costs in relation to syringes and avoidable injuries did not appear to have been incurred over more than 2 years. The study reported the average costs. The price year was not stated. A further breakdown of cost calculations for a needlestick injury is available from the authors (details not presented here).

**Statistical analysis of costs**

No statistical analyses of the costs were reported.

**Indirect Costs**

No indirect costs were reported.

**Currency**

UK pounds sterling ( ).

**Sensitivity analysis**

No sensitivity analyses were reported.

**Estimated benefits used in the economic analysis**

See the 'Effectiveness Results' section.

**Cost results**
The cost of 100 safety needles and syringes and one handle was 5.95. Extra handles cost 1.25 each.

The cost of 100 needles for a non-disposable syringe was 6.06. The non-disposable syringe cost 15 and needed replacing every 2 years.

The cost of a needle stick injury without drugs and without a starter pack was 136.04.

The cost of a needle stick injury with a starter pack, but with no further drug course, was 296.89.

The cost of a needle stick injury with a full drug course and no sickness absence was 2,151.70.

The cost of a needle stick injury with a full drug course and sickness absence was 3,845.31.

The cost per extra 3-hour counselling session (if requested) was 96.

**Synthesis of costs and benefits**
The health benefits and costs were not combined due to the cost-consequences approach adopted.

**Authors’ conclusions**
A reduction in the number of avoidable needle stick injuries can be achieved by changing to safety syringes, provided sufficient training has been given. The unqualified members of staff were at highest risk of injury. Increased awareness was also of importance in achieving this reduction. There was little cost difference between using non-disposable or safety syringes. The reductions in the cost of treating needle stick injuries, including the psychological effects, were considerable.

**CRD COMMENTARY - Selection of comparators**
A justification was given for the comparator used. The use of standard non-disposable syringes was current practice, not only in the dental school where the study was performed, but also in most dental practices in the UK. You should consider whether this is a health technology widely used in your own setting.

**Validity of estimate of measure of effectiveness**
The effectiveness analysis was quite unusual in that two study designs were used. A before-and-after design (although this classification is not strictly correct as different sub-populations were used over the two periods) was used to compare the differences in the number of avoidable injuries in the school group before and after the implementation of the safety syringes. A cohort design, following both the school and the surgery unit, was used to detect differences in the trends between both groups.

The reduction in the number of avoidable injuries may not have been entirely attributable to the introduction of safety syringes since the groups were not shown to have been comparable at analysis. In addition, the school group had lower frequencies of avoidable injuries per hour worked during the whole study period (independent of the introduction of safety syringes). The authors acknowledged that the results obtained may have resulted from other factors, such as increased staff awareness as a result of the intense training and highlighting of needle stick injuries.

The statistical analysis did not show statistically significant differences between the groups, as the number of avoidable needle injuries was very small. There was also heterogeneity in the samples in terms of the staff involved in the study groups. All these facts introduce uncertainty into the reliability of the conclusions. An additional limitation, as stated by the authors, was the fact that the number of needle-stick injuries may have been under-reported.

**Validity of estimate of measure of benefit**
The authors did not derive a summary measure of health benefit. The analysis was therefore categorised as a cost-consequences study.
Validity of estimate of costs
The authors did not state the perspective adopted. The perspective may have been that of the health service, although not all of the costs relevant to this perspective were considered in the economic analysis. The costs associated with the introduction of safety syringes (e.g. the training of qualified dentists, waste disposal bins, or the identification of storage areas) were not included, although they appear to have been relevant (for the phase of safety syringe implementation). The resource quantities and the costs were not reported separately (but are available from the author). Also, the dates to which the costs related were not given and the price year was not stated. Further, no statistical analyses on costs were performed. All these issues introduce uncertainty into the reliability of the conclusions and hinders reflation exercises to other settings. The study did not provide explicit cost results for the intervention and comparator periods, instead the economic benefits were inferred through the reduced costs of dealing with lower numbers of injuries.

Other issues
The authors compared some of the results with those from other studies. In terms of the generalisability of the results, the authors stated that the reduction of avoidable needle stick injuries in general dental practices might not be as marked as shown in the study, because the number of injuries may have been smaller.

Implications of the study
The authors recommended the change to safety syringes, not only in dental schools, but also in community dental services and general dental practice. A prospective, randomised study would assist in eliminating the highlighted limitations of the present study.

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