The cost-effectiveness of policies for the safe and appropriate use of injection in healthcare settings

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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
Scenarios that employed the use of a single-use injection were compared with a "do nothing" comparator. The do nothing strategy involved the use of contaminated needles, therefore patients were at greater risk of contracting infections.

Type of intervention
Primary prevention.

Economic study type
Cost-utility analysis.

Study population
The study population comprised a hypothetical cohort of patients who were living in the World Health Organization (WHO) sub-regions in 2000, where there had been reports of the reuse of injection equipment. The WHO had identified 14 Global Burden of Disease 2000 epidemiological sub-regions within the African Region (AFR), Region of the Americas (AMR), Eastern Mediterranean Region (EMR), European Region (EUR), South-East Asia region (SEAR) and Western Pacific Region (WPR).

Setting
The setting of this study was primary care. The economic study was carried out in Switzerland.

Dates to which data relate
The effectiveness data were obtained from literature published between 1990 and 2000, while the resource use data were obtained from studies published from 1992 to 2003. The cost data were derived using estimates. All data related to the year 2000.

Source of effectiveness data
The effectiveness data were derived from a review or synthesis of published studies or authors’ assumptions.

Modelling
A model was used to estimate the benefits and costs. No details of the design of the model were provided.

Outcomes assessed in the review
The outcomes taken from the primary studies were mortality for children and adults, and the effectiveness of interventions designed to discourage the reuse of injections.
Study designs and other criteria for inclusion in the review
Not stated.

Sources searched to identify primary studies
Not stated.

Criteria used to ensure the validity of primary studies
Not stated.

Methods used to judge relevance and validity, and for extracting data
Not stated.

Number of primary studies included
Twenty-two primary studies were included in the study.

Methods of combining primary studies
Not stated.

Investigation of differences between primary studies
Not stated.

Results of the review
The mortality rates for children were:
"high" for the sub-regions AFR D, AFR E, AMR D, EMR D and SEAR D; and
"low" for the sub-regions AMR B, EUR B, EUR C, SEAR B and WPR B.

The mortality rates for adults were:
"very high" for the sub-region AFR E;
"high" for the sub-regions AFR D, AMR D, EMR D and SEAR D; and
"low" for AMR B, EUR B, EUR C, SEAR B and WPR B.

The authors estimated that the effectiveness of interventions designed to discourage the reuse of needles was 30%.

Methods used to derive estimates of effectiveness
The authors used assumptions to estimate the effectiveness data.

Estimates of effectiveness and key assumptions
The authors assumed that, by multiplying the effect of two interventions, you would get the effect of the combined intervention.
Measure of benefits used in the economic analysis
The measure of health benefit used was the disability-adjusted life-year (DALY). The DALYs were estimated by studying the natural history of viral infections, the background mortality, the Global Burden of Disease life tables, and the average duration and disability weights of the disease of interests (i.e. acute hepatitis, cirrhosis, hepatocellular carcinoma and AIDS). The DALYs were discounted at a rate of 3% per annum.

Direct costs
The direct costs recorded in this study were for the intervention to reduce injection use and the intervention to reduce unsafe use of injections. These included the costs of the injection equipment (based on the international retail price and transport cost) and waste management, and were obtained from an existing database. The cost of staff time to administer the injections was also included. All of the costs were recorded for a 10-year period, then averaged to give the yearly cost and subsequently the year 2000 price.

Statistical analysis of costs
The data were deterministic. No tests were carried out.

Indirect Costs
No indirect costs were included in the study.

Currency
The currency used was international dollars (I$) for the year 2000.

Sensitivity analysis
The sensitivity analysis assessed several variables. In particular, the comparative risk assessment (upper and lower values), the effectiveness of the interventions (7% for reducing injection use and 50% for reducing unsafe use of injections), and the number of syringes and needles needed (upper value). In addition, a scenario was run in which the cost of safe sharps waste collection and management was not taken into consideration.

A Monte Carlo technique was employed to look at the "stochastic uncertainty analysis of the probability that interventions represent a cost-effective use of resources given a specified budget constraint" for costs and effects.

Estimated benefits used in the economic analysis
The number of injections per person per year for all the sub-regions was 3.4.

The proportion of reuse for all sub-regions was 39.8%.

The contaminated injections were predicted to cause 21 million HBV infections (49,000 deaths), 2 million HCV infections (24,000 deaths) and 260,000 HIV infections (210,000 deaths) between 2000 and 2030. This led to 9,177,679 discounted age-weighted DALYs or 48,541,032 non-discounted unadjusted DALYs.

The intervention to reduce injection use led to a reduction of 2,753,304 DALYs.

The intervention to reduce the unsafe use of injections led to a reduction of 8,718,795 DALYs.

If these two interventions had been combined they would have led to a reduction of 8,856,461 DALYs.

Cost results
The expected annual cost of the interventions to reduce injection use ranged from I$ 1.1 million in AMR D to I$ 26
million in WPRB, with a cost per capita of IS 0.009 to IS 0.024, respectively.

The expected annual cost of the interventions to reduce the unsafe use of injections ranged from IS 2.5 million in AMR D to IS 459 million in SEAR D, with a cost per capita of IS 0.01 to IS 0.44, respectively.

The estimated yearly cost of combined interventions ranged from IS 3 million in AMR D to IS 466 million in SEAR D, with a cost per capita of IS 0.03 to 0.45, respectively.

The sensitivity analysis showed that a higher attributable fraction decreased the average cost per DALY by 19% to 86%. Removing the cost of sharps waste management had no influence. The attribution of a lower fraction of injection-related infections increased the average cost per DALY averted. When the minimum estimate of the intervention’s effectiveness was used in conjunction with lower attributable fractions, this increased the cost-effectiveness ratio. Using the lower attributable fraction, the minimum effectiveness, and a doubled number of syringes and needle sets led to a 4- to 10-fold increase in the average cost per DALY averted. Even in the worst-case scenario, the average cost-effectiveness ratio of all the interventions remained below the threshold of average annual income per capita. At low levels of resource availability, the reduction of injection use was the most cost-effective strategy in most of the sub-regions. At higher levels, the combination strategy was the most cost-effective.

**Synthesis of costs and benefits**

The average cost-effectiveness ratio for interventions to reduce injection use ranged from IS 7 (AFR E) to IS 5,124 (EUR B) per DALY averted.

The average cost-effectiveness ratio for interventions to reduce the unsafe use of injection, including waste management, ranged from IS 12 (AFR E) to IS 1,107 (EUR B) per DALY averted.

The average cost-effectiveness ratio for combined interventions for the safe and appropriate use of injections, including waste management, ranged from IS 14 (AFR E) to IS 2,293 (EUR B) per DALY averted.

There were six sub-regions in which the proportion of reused injection equipment exceeded 15%. In these regions the most cost-effective strategy was the intervention to reduce injection use. In the other four sub-regions, the most cost-effective strategy was the intervention to reduce the unsafe use of injections. In all the sub-regions, the average cost-effectiveness ratio of the combined intervention strategy was under the threshold of the one-year average per capita income.

**Authors’ conclusions**

Whilst the reuse of injections is not a major cause of disability and death, the safe and appropriate use of injection equipment can avert a large number of disability-adjusted life-years (DALYs) at a relatively low cost, and is therefore cost-effective.

**CRD COMMENTARY - Selection of comparators**

Although the comparator used was not explicitly justified, it represents current practice. You should decide if the comparators represent current practice in your own setting.

**Validity of estimate of measure of effectiveness**

The authors did not state that a systematic review of the literature had been undertaken. The authors used data from the available studies selectively and did not consider the impact of differences between the primary studies when estimating the effectiveness.

**Validity of estimate of measure of benefit**

The summary measure of benefit was the DALY, which is an appropriate measure when estimating the health status of a population. The future benefits were discounted appropriately.
Validity of estimate of costs
The authors did not state what perspective the study was conducted from but, as only the direct costs were included, it would appear that the perspective adopted was that of the health care provider. A sensitivity analysis of the quantities and prices was conducted, using ranges that appear to have been appropriate.

Other issues
The authors made appropriate comparisons of their findings with those from other studies. The results were not presented selectively. The authors assumed that, where injections were given in the public sector, the coverage was 100%. You, should decide whether this is appropriate for your setting.

The authors reported a number of limitations to their study. For example, the cost in terms of burden of disease caused by needlestick injuries to the waste collection and management employers was not included. This could cause the cost-effectiveness to be greater than reported in the study. Also, the long-term implications of reducing the "prevalence of infections with blood borne pathogens" was not taken into account, nor the fact that a large proportion of healthcare service provisions are from the private sector.

Implications of the study
The implementation of improved injection practice should be recommended in areas where reuse of injection equipment is common and the prevalence is greater that 1%. Policies should aim to lead to a better coordination of any such programmes that are already in existence.

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