Cost-effectiveness of harm reduction in preventing hepatitis C among injection drug users

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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 a syringe exchange programme (SEP), aimed at reducing the incidence and prevalence of hepatitis C (HCV) among injection drug users (IDUs).

Type of intervention
Primary prevention.

Economic study type
Cost-effectiveness analysis.

Study population
The study population comprised IDUs.

Setting
The setting was the community. The economic study was carried out in the USA.

Dates to which data relate
The effectiveness evidence was gathered from studies published between 1989 and 1998. The price year was not reported.

Source of effectiveness data
The effectiveness evidence was derived from published studies.

Modelling
A susceptible-infected, random-mixing mathematical model of disease spread was used to assess the endemic steady-state incidence and prevalence of HCV. More importantly, the model was also used to observe the convergence to the steady state with high-infection rates, from initial conditions of low prevalence of the disease. This analytic approach has been widely used to examine the efforts to prevent human immunodeficiency virus (HIV) and AIDS. Within the framework, SEP was supposed to reduce the degree of infection associated with unsafe needle sharing and, thereby, the incidence and prevalence of HCV. To provide a tractable analytic model the following assumptions were made:

all IDUs had identical risk behaviour,

sexual risk was not considered, and

sharing occurred through a process of random mixing across the IDU population.
Outcomes assessed in the review
The model parameters derived from the literature were the infection rate, the exit rate from the active IDU population, the arrival rate into shooting galleries, and the reduction of short-term disease attributable to SEP. Other important model inputs were calculated analytically.

Study designs and other criteria for inclusion in the review
Not reported.

Sources searched to identify primary studies
Not reported.

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

Methods used to judge relevance and validity, and for extracting data
No reported.

Number of primary studies included
Six primary studies provided the inputs for the model. Several other published studies were also used to construct the model.

Methods of combining primary studies
Not carried out.

Investigation of differences between primary studies
Not reported.

Results of the review
The infection rate ranged from 0.005 to 0.05.

The exit rate from the active IDU population was 1 every 4,000 days, with a feasible range between 1 every 6,320 days and 1 every 2,920 days.

The arrival rate into shooting galleries was 1 every 7 days.

The proportional reduction of short-term disease attributable to SEP was 1/3.

Measure of benefits used in the economic analysis
The benefit measures used in the analysis were the time to convergence (from the initial conditions of disease prevalence to endemic steady-state prevalence), and the impact of SEP on steady-state prevalence. These were obtained from the analytic model.

Direct costs
Discounting was not reported. Only the cost of SEP per day and per client was used in the analysis. The estimation was derived from a published study. The price year was not reported.
Statistical analysis of costs
No statistical analysis was reported.

Indirect Costs
No indirect costs were included.

Currency
US dollars ($).

Sensitivity analysis
Sensitivity analyses were conducted to investigate the robustness of the model and to identify critical parameters for public policy. Several parameters were investigated. The type of analyses was not specified, but it appears that one-way sensitivity analyses were carried out.

Estimated benefits used in the economic analysis
Time to convergence, from the initial conditions of disease prevalence to endemic steady-state prevalence.

When the infection rates were low, the convergence times were quite long. For an infection rate of 0.005, the convergence time was longer than 26 years. However, for infection rates greater than 0.01, convergence was achieved in less than 11 years.

Impact of SEP on steady-state prevalence (difference between the steady state, with and without a SEP).

At low levels of infection rates, SEP was very effective in slowing disease spread. However, as the infection rates increased, SEP was observed to have a small impact on disease spread. For example, if the productive rate of infection (Ro) was 2.9, the steady-state prevalence would be reduced from 65 to 47.5%. However, if Ro was 6.9, the change would be from 85 to 78%. Ro is directly proportional to the infection rate.

Cost results
The cost of SEP per day per client was $5. The costs per IDU were not given.

Synthesis of costs and benefits
The costs and the benefits were combined by estimating the cost per averted infection at different infection rates, from the model's results (at convergence to steady-state conditions). At relatively low observed rates of infection, the costs per averted infection were far below the commonly used cost-effectiveness thresholds applied to other life-saving interventions. However, at higher infection rates (Ro=2.9), SEP became more and more ineffective. The cost per averted infection exceeded $250,000, and reached $1,000,000 in what were stated to be high-risk populations. The sensitivity analyses indicated that the infection rate was the most important variable in the model.

Authors' conclusions
The costs per averted infection within realistic populations of injection drug users (IDUs), with very high infection rates, far exceeded the conventional cost-effectiveness thresholds used in the health care system. Further, a short-term incidence analysis could lead to incorrect estimates of the effectiveness of a syringe exchange programme (SEP). A long-term time horizon should therefore be adopted in an economic analysis.

CRD COMMENTARY - Selection of comparators
SEP was compared with a do-nothing alternative (absence of SEP). In other words, the authors assessed the costs and the benefits of SEP on the basis of the convergence time needed for SEP to reach the steady state, over a situation where SEP was not adopted (natural convergence to the steady state). You should consider whether this represents a real alternative to SEP in your own setting.

Validity of estimate of measure of effectiveness
The effectiveness estimates used as model parameters were derived from primary studies, which were not combined by specific techniques. There were no details of the sources searched to identify the primary studies. In addition, the methods used to select the studies, and the criteria used to ensure their validity, were not reported.

Validity of estimate of measure of benefit
The estimation of the benefits was modelled using an analytic model. This appears to have been appropriate to simulate the disease progression and the impact of SEP. However, some assumptions were made in the model, which could have reduced the generalisability of the results.

Validity of estimate of costs
The perspective of the study was unclear and some of the cost categories could, therefore, have been omitted. It appears reasonable that the cost items included in the analysis could vary substantially for different resource/cost boundaries. The present study only included the cost of SEP per day per person. The price year was not reported. In addition, statistical analyses were not conducted on the cost side of the analysis.

Other issues
The authors made interesting comparisons of their findings with those of other studies, especially with regards to HIV and AIDS. The generalisability of the results to other settings with differing prevalence was partially addressed, by sensitivity analyses on the effectiveness estimates. The authors recognised that some limitations of the analysis could have been overcome by adopting a more sophisticated model.

Implications of the study
In terms of public policy, the authors suggested that an effective strategy should combine multiple interventions that reduce both the prevalence of injection drug use and the transmission of HCV among IDUs. However, the costing was very limited and the effectiveness depended on a set of assumptions, which were questionable. Therefore, this study serves more to demonstrate the use of an effectiveness model, for which the authors give some evidence of validity.

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