Benefits and costs of methadone treatment: results from a lifetime simulation model
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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 modelled compared the use of methadone treatment versus no treatment in heroin drug users.

Type of intervention
Treatment.

Economic study type
Cost-benefit analysis.

Study population
As this was a modelling study, 1 million male and female persons aged between 18 and 60 years were modelled. The cohort comprised users and non-users of heroin. No further inclusion or exclusion criteria were reported.

Setting
Although the setting was not explicitly stated at the outset, it appears that the study was carried out in a community setting. The economic study was carried out in the USA.

Dates to which data relate
The effectiveness and demographic data were derived from sources published between 1995 and 2000. The cost data were derived from sources published between 1994 and 2004. All costs were reported for the price year 2001.

Source of effectiveness data
The data were derived from a review and synthesis of published studies. Effectiveness data not available in the literature were calculated or derived from existing data, or were augmented by authors’ assumptions.

Modelling
The authors constructed a Monte Carlo simulation model to estimate the costs and benefits associated with drug use and/or treatment episodes over the individual’s lifetime. One million male and female adults aged between 18 and 60 years, who could or could not be heroin users, progressed into the model in order to derive information on heroin use, entry into methadone treatment, employment, health care use, criminal behaviour, arrests and incarceration. Several scenarios, in addition to baseline, were evaluated in the model. Specifically, an increase in the probability of going to treatment, an increase in length of stay in treatment, and no treatment scenario.

Outcomes assessed in the review
The main effectiveness parameter concerning heroin treatment used in the model was the probability that a heroin user aged 18 to 25 years, who had received treatment, resumed heroin use within one month. There were many other clinical
and epidemiological parameters in the model relating to heroin use and crime that are too numerous to mention here.

**Study designs and other criteria for inclusion in the review**
The authors reported that much of the data were derived from cross-sectional studies and from studies that used cross-sectional data.

**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**
Not reported.

**Number of primary studies included**
The authors used 11 primary studies as sources of effectiveness evidence.

**Methods of combining primary studies**
Not reported.

**Investigation of differences between primary studies**
It appears that differences between the primary studies have not been investigated.

**Results of the review**
The probability that a non-user who previously used heroin resumed heroin each month was 20%.

The other results of the review are too numerous to report here. However, all outcomes were fully reported. The reader is referred to Table 2 of the current study for details.

**Methods used to derive estimates of effectiveness**
Due to a lack of data in the literature, some estimates of effectiveness were based on authors' assumptions.

**Estimates of effectiveness and key assumptions**
Based on the authors' experience and on related data in the literature, it was assumed that "non-users" with a history of heroin use incurred a higher risk of taking up heroin use again, compared with the initiation risk for individuals without a history of heroin use. In addition, this greater risk was correlated with the individual's age and treatment history. Other parameters also based on authors' assumptions were the relative risk of user initiating treatment given previous treatment history (versus users with no treatment history) and the monthly probability of an individual committing a crime when he or she has committed a crime during the previous month.

**Measure of benefits used in the economic analysis**
Based on the human capital approach, monetary benefits based on wages were used in the economic analysis. The net lifetime economic benefits were computed as the discounted earnings minus the sum of health care costs and costs
associated with crimes. Potential benefits were therefore an increase in employment and a reduction in crime. Benefits that were not combined with the costs were life-years (i.e. the number of years that individual live after the age of 18).

**Direct costs**
The following health care costs were used in the analysis:

- the cost per crime (computed as a weighted average from a listing per criminal victimisation including murder, rape and sexual assault, robbery, burglary or attempt of burglary, larceny-theft);
- the cost per arrest (computed as a weighted average of costs for tried and dismissed cases);
- the cost per incarceration incurred at start of incarceration and the monthly cost of incarceration (both of these included court costs);
- the cost per use of inpatient services for non-users and users;
- the cost per use of outpatient services;
- the cost per use of emergency department services;
- the monthly cost of methadone treatment (including only costs incurred by the treatment provider, and excluding time and monetary costs incurred by the patient).

The costs were derived from published sources, while the quantities of resources used were derived directly from the model. The costs and the quantities were not reported separately, and the authors only reported summary costs. When lifetime costs for each category of costs were estimated, the costs were appropriately discounted and adjusted to reflect 2001 prices.

**Statistical analysis of costs**
The costs were treated deterministically.

**Indirect Costs**
Employment earnings for male and female users and non-users in the three age groups (i.e. 18 - 25, 26 - 34, and 35 - 60 years old) were included in the analysis. The costs were derived from published sources and were adjusted to reflect 2001 prices. The costs were appropriately discounted when lifetime earnings were estimated.

**Currency**
US dollars ($).

**Sensitivity analysis**
The authors conducted multiple sensitivity analysis to test the robustness of the results to variability in the data. The following parameters were tested in sensitivity analysis:

- the probability of initiating heroin use;
- the relative risk that non-using ever-users resume heroin use;
- the probability that never-users start use;
- the probability that users enter treatment;
the probability that users stop using heroin without treatment;

the probability of committing a crime; and

the mortality rate for users and non-users in treatment.

The ranges used in the sensitivity analysis and the sources of these ranges were not reported.

**Estimated benefits used in the economic analysis**

For ever-users, no treatment resulted in lifetime earnings of $84,722 per individual, treatment resulted in earnings of $236,012, increased access resulted in earnings of $295,326, and increased length of treatment resulted in earnings of $241,279.

For ever-users, no treatment resulted in lifetime crime costs of $1,064,046 per individual, treatment resulted in lifetime crime costs of $1,061,639 per individual, increased access resulted in lifetime crime costs of $972,115, and increased length of treatment resulted in lifetime crime costs of $1,021,013.

**Cost results**

For ever-users, no treatment resulted in lifetime treatment costs of $16,819, treatment resulted in lifetime treatment costs of $17,431, increased access resulted in lifetime treatment costs of $17,417, and increased length of treatment resulted in lifetime treatment costs of $17,238.

**Synthesis of costs and benefits**

The authors calculated the net monetary outcome for each intervention, which was the net earnings less the sum of the health care costs and costs associated with crimes. No incremental outcomes were calculated. No treatment resulted in a net benefit of -$987,518, treatment resulted in a net benefit of -$843,058, increased access resulted in a net benefit of -$694,206, and increased length of treatment resulted in a net benefit of -$796,972.

The sensitivity analysis demonstrated that as far as ever-users were concerned, the results were robust to most variations in the parameters. However, it was reported that a decrease in propensity to commit crimes had a significant impact on the mean number of crimes committed. This resulted in greater decreases in the mean lifetime crime costs and, therefore, greater increases in the mean per-individual economic benefits. Further, a reduction in mortality rate among heroin users had an impact on life-years, the number of years using heroin, and on the mean lifetime crime costs.

**Authors' conclusions**

Increasing access to treatment has a positive impact on treatment benefits and costs. Compared with the option of increased length of stay in treatment, the analysis demonstrated that "a treatment access intervention dominates a policy that improves the treatment process by lengthening the stay in treatment".

**CRD COMMENTARY - Selection of comparators**

The choice of the comparators was explicitly justified. The authors only investigated the methadone treatment option and did not discuss the existence of alternative treatment options (i.e. non-methadone treatments). If there are any other such alternatives, which is likely, it makes this study only a partial analysis.

**Validity of estimate of measure of effectiveness**

No systematic review of the literature was reported. Although this is common practice with models, it does not always ensure that the best available data are used in the model. The authors appear to have used data from the available studies selectively. In addition, the impact of differences between available studies when extrapolating effectiveness estimates was not investigated. However, the authors carried out a number of sensitivity analyses relating to the efficacy
estimates. These analyses improve both the internal validity and the generalisability of the study by demonstrating the robustness of the results to changes in the base-case estimates. Some estimates of effectiveness were based on authors' assumptions. The authors justified their assumptions with reference to the medical literature.

Validity of estimate of measure of benefit
The authors used monetary benefits in the economic analysis, according to a human capital approach where benefits and earnings were calculated.

Validity of estimate of costs
The perspective adopted in the economic analysis was not explicitly stated, although it appears to have been societal as a wide range of outcomes were costed. The authors reported summary costs, making it difficult to know which aspects of costs were included in each category (e.g. overhead costs, professional time costs). The costs and the quantities were not reported separately, which will not enable the analysis to be easily reworked for other settings. The costs were treated deterministically, and no sensitivity analysis on the costs, quantities or resources used was undertaken to assess the robustness of the estimates used. This may limit the interpretation of the study findings. All costs were appropriately inflated and discounted and the price year was reported, which will aid any future reflation exercises.

Other issues
The authors also constructed a static model estimating the benefit-cost of a single treatment episode, and the results were in agreement with those of other published studies. However, the authors did not compare the findings of the lifetime model since there was a lack of published studies in the same area. The authors did not directly address the issue of generalisability of the results to other settings. The results were specifically related to the USA. The authors do not appear to have presented their results selectively. The authors reported a number of limitations to their study. For example, they used a number of simplifying assumptions to the model. The model was restricted to community-based outpatient methadone treatment and excluded the provision of treatment to individuals in the criminal justice settings. The authors felt that the benefit-cost ratios may be an overestimate since the treatment costs were only accounted for from the perspective of the treatment provider and not from the patient's perspective.

Implications of the study
The authors did not make any explicit recommendations for changes in policy or practice. However, they highlighted several areas for future research. They called for further research to certify the conclusion that a treatment access policy is superior to a policy that improves the treatment process by prolonging the duration of treatment. They stressed the need for research on related crime parameters that will provide more robust data. Lastly, they called for models that will investigate non-methadone treatment options and account for the provision of treatment to incarcerated individuals.

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