Economic evaluation of Safer Choices: a school-based human immunodeficiency virus, other sexually transmitted diseases, and pregnancy prevention program

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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 school-based programme, Safer Choices, was examined. The programme was aimed at preventing human immunodeficiency virus (HIV), infection by other sexually transmitted diseases (STDs) such as chlamydia, gonorrhoea infections and pelvic inflammatory disease, and unintended pregnancy among adolescents. Safer Choices was a 2-year, theory-based multi-component intervention carried out to increase condom and contraceptive use.

Type of intervention
School-based primary prevention programme.

Economic study type
Cost-effectiveness analysis.

Study population
The study population comprised high-school students.

Setting
The setting was a school. The economic study was carried out in several schools in California and Texas, USA.

Dates to which data relate
The effectiveness evidence and resource use data were collected from 1991 to 1999. The price year was 1994.

Source of effectiveness data
The effectiveness evidence was derived from a single study and a review of published studies. It was augmented by estimates made by the authors.

Link between effectiveness and cost data
The costing was carried out retrospectively on a patient sample similar (in part) to that used in the effectiveness analysis.

Study sample
Power calculations to determine the sample size were not performed. The participants were students attending the schools involved in the study. The sample comprised 3,677 ninth-grade students who remained in the study at the first follow-up interview, of which 47.5% were male. The students were 31% white, 27% Hispanic, 18% Asian or Pacific Islander, 17% African American, and less than 1% American Indian or Alaskan native.
Study design
This was a randomised trial carried out in 10 schools in northern Carolina and 10 schools in south-east Texas. Five schools in each state were randomly assigned to the intervention group (Safer Choices), while the remaining schools were assigned to the control group (no intervention). The method of randomisation was not reported. The students were followed for 31 months and the follow-up assessments were carried out at 7, 19 and 31 months. However, only 7-month follow-up results were considered in the present study.

Analysis of effectiveness
The basis for the analysis of effectiveness (intention to treat or treatment completers only) was not reported. The primary health outcome was the increase in both condom and contraceptive use. Due to some variability in the baseline characteristics in the study groups, the authors stated that multilevel statistical analyses were carried out to take into account potential bias and clustering effects within schools.

Effectiveness results
The analysis found a significant increase in condom, (p=0.02) and contraceptive use, (p=0.03) at last intercourse among the 345 students who reported having sex in the last 3 months.

The Safer Choices programme appeared effective after 7 months (first follow-up assessment), since 52% of the students in the control group and 67% of those in the intervention group reported using condoms at last intercourse. In addition, 57% of the students in the control group and 68% of those in the intervention group used contraception at last intercourse.

Clinical conclusions
The effectiveness analysis showed that the Safer Choices programme was highly effective in increasing condom and contraceptive use among high-school students.

Modelling
A Bernoulli model of HIV transmission was used to translate the increase of condom used into cases of HIV and other STDs averted on the basis of four variables. The variables were the number of sexual partners, the number of sexual contacts with each partner, HIV prevalence, and probability of transmission. A pregnancy model was also constructed to translate contraceptive use into cases of pregnancy averted.

Outcomes assessed in the review
The outcomes assessed from published studies that were used as input parameters in the models were:

- the HIV prevalence rate or STD incidence rate of sexual partners;
- the probability of transmission following a single sex act;
- the effectiveness of condoms in preventing HIV and other STDs;
- the probability of condom use per act;
- the number of contacts with one partner within the last 3 months;
- the number of partners per student within the last 3 months;
- the probability that ovulation in a given month can support pregnancy;
- the probability of coitus in the fertile period;
the probability of fertilisation given coitus in the fertile period;
the probability that a conception is recognised, given that fertilisation occurs;
the frequency of student sexual contacts within one month; and
the percentage of students using contraception.

**Study designs and other criteria for inclusion in the review**
Not stated. However, some studies were official reports from bodies such as the US Preventive Services Task Force or Centres for Disease Control and Prevention.

**Sources searched to identify primary studies**
Not stated.

**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**
Six primary studies were the main source of the effectiveness evidence.

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

**Investigation of differences between primary studies**
Not stated.

**Results of the review**
The prevalence rates of HIV, chlamydia, and gonorrhoea were 0.001, 0.117 and 0.009 in the age range 15 to 19 years. The rates were 0.004, 0.038 and 0.004 in the age range 10 to 44 years.

The probability of transmission following a single sex act was 0.016 (range: 0.001 - 0.030) for HIV, 0.450 (range: 0.350 - 0.550) for chlamydia, and 0.530 (range: 0.350 - 0.700) for gonorrhoea.

The effectiveness of condoms in preventing HIV and other STDs was 0.95 for HIV, chlamydia and gonorrhoea.

For HIV, chlamydia and gonorrhoea, the probabilities of condom use per act were 0.52 in the control group and 0.67 (range: 0.64 - 0.70) in the intervention group.

The number of contacts with one partner within the last 3 months was 3.63 in the intervention group. The number of partners per student within the last 3 months was 1.83.

The probability that ovulation in a given month can support pregnancy was 0.45.

The probability of coitus in the fertile period was 0.18.
The probability of fertilisation given coitus in the fertile period was 0.95.

The probability that a conception was recognised, given that fertilisation occurs, was 0.61.

The frequency of student sexual contacts within one month was 2.22 in the intervention group.

The proportion of students using contraception was 57% in the control group and 68% (range: 65 - 71) in the intervention group.

**Methods used to derive estimates of effectiveness**
The authors made some assumptions to populate the model and to support the data derived from the literature and the single study. The authors also calculated some data.

**Estimates of effectiveness and key assumptions**
The authors assumed the following:

- all sexual partners were of the opposite sex;
- the sexual partners of intervention students were from a pool outside of the intervention group;
- the intervention prevented both disease transmission from infected sexual partners to uninfected intervention students (primary transmission) and transmission from infected intervention students to uninfected sexual partners (secondary transmission);
- the HIV prevalence rates and STD incidence rates among sexual partners of intervention students were the average rates of two age groups, those aged 15 to 19 years and those aged 10 to 44 years;
- condom use per act was equal to the percentage of students using condoms at last intercourse; and
- the intervention effect lasted for one year.

The average prevalence rate was 0.002 (range: 0.001 - 0.004) for HIV, 0.078 (range: 0.038 - 0.117) for chlamydia, and 0.006 (range: 0.004 - 0.009) for gonorrhoea.

The number of uninfected students in the intervention group was 343.70 for HIV, 185.17 for chlamydia, and 332.96 for gonorrhoea.

The number of uninfected sexual partners of infected students was 2.37 for HIV, 269.80 for chlamydia, and 21.90 for gonorrhoea.

The probability of becoming pregnant without contraceptive use was 0.05 within 1 month and 0.43 within one year.

The proportion of women who experienced a contraceptive failure within one year of initiating contraception was 9% (range: 5 - 13).

The number of female students plus number of female partners of male intervention students was 488.18.

**Measure of benefits used in the economic analysis**
The benefit measures used in the economic analysis were the number of cases of HIV, chlamydia, gonorrhoea, pelvic inflammatory disease and pregnancy averted. All measures were obtained from the models.

**Direct costs**
A 5% discount rate was used since the costs appear to have been incurred over 2 years. The unit costs and the quantities of resource used were reported. The cost/resource boundary adopted was that of the payer. In particular, payer perspectives were reported for private and public sectors. Due to the lack of data concerning public sector costs, the authors assumed that the costs in the public sector were 50% of those in the private sector.

The costs included in the analysis were for the programme, condom and contraceptives, treatment of HIV and STD, and pregnancy consequences (abortion, miscarriage, live birth, and prenatal care). The programme costs included school organisation, curriculum and staff development, peer resources, school environment, parent education, and school-community linkages. The costs of developing and evaluating the programme were excluded. The costs and the quantities of resources used were derived mainly from published data, such as official reports or primary studies. The net benefit of the Safer Choices programme was obtained by dividing the total medical costs averted (calculated as the number of cases averted multiplied by the cost per case) by the intervention costs (programme plus condom and oral contraceptives costs). The data on resource use were collected from 1991 to 1999. The price year was 1994.

**Statistical analysis of costs**
Statistical analyses of the costs were not carried out.

**Indirect Costs**
The societal costs of preventing HIV and pregnancy were included in the analysis. These were calculated as the number of cases averted multiplied by the estimated societal cost per case. The discount rates used were 6 and 5%. The unit costs and the quantities of cases averted were reported. The analysis of the indirect costs included lost productivity, costs of earning-related outcomes, public assistance, and other consequences. The indirect costs were estimated on the basis of published studies and the authors' assumptions.

**Currency**
US dollars ($).

**Sensitivity analysis**
A multivariate sensitivity analysis was conducted to assess the robustness of the base-case results. The model inputs varied were the probability of HIV and other STD transmission, HIV prevalence rate, STD incidence rates, condom use per act, contraceptive failure rate, the percentage of students using contraceptives, and medical cost per case.

**Estimated benefits used in the economic analysis**
The number of cases averted was 0.12 for HIV, 24.30 for chlamydia, 2.77 for gonorrhoea, 5.86 for pelvic inflammatory disease and 18.50 for pregnancy.

**Cost results**
The total costs to implement the programme were $102,852, and the total cost of the contraceptives was $2,391. Thus, the total programme costs were $105,243.

The medical costs averted were $139,806 and the societal costs averted were $139,713. Thus, the total averted costs were $279,519.

Overall, the net benefit was $174,276. The benefit-cost ratio was 2.65, meaning that for every dollar invested in the programme, $2.65 in total medical and societal costs were saved.

The estimated net benefit was fairly robust to variations in different variables. However, two specific scenarios were unfavourable to the programme. The first scenario was characterised by a low probability of HIV or STD transmission, low percentage of students using contraceptives, high contraceptive failure rate, low medical costs, and low prevalence...
or incidence rate. The second scenario was similar to the first, except that low condom use per act was used instead of low prevalence or incidence rate.

The authors pointed out that "although not cost-saving, the 2 scenarios may well be cost-effective, because the total costs averted in the scenarios are close to the intervention cost”.

Synthesis of costs and benefits
The costs and the benefits were not combined.

Authors’ conclusions
The Safer Choices programme was generally cost-effective and cost-saving. The results were fairly robust to variations in the key variables.

CRD COMMENTARY - Selection of comparators
The rationale for the choice of the comparator was clear. The programme was compared with a no-programme option, which was based on the standard intervention carried out in high schools. You should assess whether a school-based primary prevention programme for HIV and STDs is implemented in your own setting.

Validity of estimate of measure of effectiveness
The effectiveness evidence was obtained from different sources. The analysis of the single study used a randomised design, which enhanced the internal validity of the study. However, data obtained from the published studies were pooled together, but the comparability of the study populations and the method used to combine the studies were not reported. Finally, the authors did not justify their assumptions, although some sensitivity analyses were carried out to overcome the uncertainty associated with the data used in the decision model.

Validity of estimate of measure of benefit
The benefit measures used in the economic analysis were the number of cases of HIV, STDs, and pregnancy averted. These were derived from the analytic model. The measures appear to have been appropriate for estimating the impact of the prevention programme on the study population. However, no summary benefit measure was used to combine the costs and the benefits.

Validity of estimate of costs
All the categories of costs relevant to the societal perspective adopted in the study appear to have been included in the analysis. The authors made some assumptions to overcome the lack of cost data. The unit costs and the quantities of resource use were reported separately, thus enhancing the external validity of the analysis. Although the costs were treated deterministically in the base-case, the medical cost per case was varied in the sensitivity analysis. The authors recognised that the costs may vary by geographic area.

Other issues
The authors made some comparisons of their findings with those from other studies. The issue of the generalisability of the study results to other settings was not explicitly addressed, but appropriate multivariate sensitivity analyses were conducted on key variables. High-school students were enrolled in the study and this was reflected in the authors’ conclusions. The authors reported some limitations of their analysis. In particular, the short time horizon, the lack of precise estimates for some data used in the model, and some of the assumptions. For example, the assumption that all relationships were of a heterosexual nature and that the sexual partners of intervention students were from a pool outside of the intervention group.
Implications of the study
The authors suggested that specific prevention programmes, such as Safer Choices programme, should be implemented in high schools. In addition, decision-makers should take into account several factors such as programme costs and prevalence and incidence rates. Further studies should focus on the analysis of the costs and outcomes related to adolescent pregnancy.

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