The cost-effectiveness of intensive national school-based anti-tobacco education: results from the tobacco policy 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 health intervention examined in the study was a school-based, intensive, anti-tobacco programme aimed at reducing tobacco use among teenagers. The programme used specially trained tobacco educators who would go into the schools to deliver a specific curriculum.

Type of intervention
Primary prevention.

Economic study type
Cost-effectiveness analysis; Cost-utility analysis.

Study population
The study population comprised a hypothetical cohort of 7th and 8th grade students.

Setting
The setting was community. The economic study was conducted in the USA.

Dates to which data relate
The effectiveness evidence came from studies published between 1989 and 2000. No explicit dates were reported for resource use. The price year was 1999.

Source of effectiveness data
The effectiveness evidence came from a review of the literature and authors' assumptions.

Modelling
An epidemiological model, the Tobacco Policy Model (TPM) was constructed to estimate the expected costs and benefits associated with the intensive programme in comparison with the standard programme. This Markovian system dynamic computer simulation model followed the entire US population, which was divided into different cohorts according to age, gender, and smoking status. Three subgroups of individuals were classified according to their smoking status: current smokers, former smokers, and never smokers. Three changes in smoking behaviour were considered: initiation, cessation, and relapse. The cycles of the model were annual. The initial cohort started in 2001 and two time horizons were considered: 25 and 50 years.

Outcomes assessed in the review
The outcomes assessed from the published studies were demographic data on the US population (by age and gender).
prevalence data on US population tobacco use, tobacco use behaviour-change probabilities, fertility, mortality, average student class size, length of curriculum in 7th grade, length of booster in 8th grade, length of school year, annual turnover rate among teachers, quality of life (QoL) associated with health problems due to smoking for children, and the effectiveness of the programme.

Study designs and other criteria for inclusion in the review
The inclusion criteria were not reported because a systematic review of the literature was not undertaken. However, most of the data on the US population came from official statistics, such as the Bureau of Census. Data on programme effectiveness came from seven studies, among which there was one meta-analysis.

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
Seventeen primary studies were used to derive the effectiveness evidence.

Methods of combining primary studies
Not stated.

Investigation of differences between primary studies
Not stated.

Results of the review
The QoL values were 0.94 for children aged 0-5 years and 0.93 for children aged 6-8 years (the estimate for those aged 9-16 years was obtained fitting a piecewise linear function between the value at 8 years and the value at 17 years; but the figure was not reported).

With respect to the effectiveness of the programme, six scenarios were considered on the basis of the data observed in the literature: the percentage reduction in the increase in the prevalence of current smoking was 5.8% for scenarios 1 and 2, 35% for scenarios 3 and 4, and 64% for scenarios 5 and 6 for 7th grade students; and 5% for scenarios 1 and 2, 30% for scenarios 3 and 4, and 56% for scenarios 5 and 6 for 8th grade students.

Data regarding the US population were not reported.

Methods used to derive estimates of effectiveness
The authors made some assumptions, which were used to derive effectiveness estimates used as inputs in the simulation model.

Estimates of effectiveness and key assumptions
It was assumed that all children under age 8 were never smokers. The number of classes one educator could visit per day was 2. The number of 7th grade curricula one educator could offer per year was 36. The number of 8th grade boosters one educator could offer per year was 180. Among the numerous QoL estimates (which were obtained from a personal communication), the authors reported those for males, aged 40-44 years, current smoker (0.82), former smoker (0.88), and never smoker (0.90), and for females, aged 40-44 years, current smoker (0.83), former smoker (0.87), and never smoker (0.88). The authors also made some assumptions with respect to the attributable risk, namely the proportion of deaths or illnesses that could be attributed to the smoking behaviour: it was assumed that youths who did not smoke as a result of the educational intervention would have the health and medical cost profile of a typical never smoker.

**Measure of benefits used in the economic analysis**
The summary benefit measures were life-years (LYs) gained in the cost-effectiveness analysis (CEA) and quality-adjusted life-years (QALYs) gained in the cost-utility analysis (CUA). Both were obtained through the simulation model. A 3% annual discount rate was used as two time horizons were used: 25 and 50 years.

**Direct costs**
Discounting was conducted (3% annual rate) because costs were incurred over a period of 25 or 50 years. Unit costs were not reported separately from quantities of resources used. The health services included in the economic evaluation were programme costs (teaching time, educator training, and classroom materials) and direct medical costs. All costs that were too small to affect total costs, such as facility costs, were not considered in the analysis. The cost/resource boundary of the analysis was not clear. The estimation of resource use was based on data from the Project "Towards No Tobacco Use" (TNT) as an exemplar, and on authors' assumptions. Unit costs came from average national salaries and a nonprofit publisher of health education resources. Medical care costs were estimated from a published study (see "Other Publications of Related Interest" below), and regression techniques were used when data were not directly available. All costs were inflated to 1999 values using the medical care component of the Consumer Price Index.

**Statistical analysis of costs**
Costs were treated deterministically in the base case.

**Indirect Costs**
Indirect costs were not included in the economic evaluation.

**Currency**
US dollars ($).

**Sensitivity analysis**
Sensitivity analyses were conducted to estimate the impact of uncertainty on the results of the CEA and CUA. A three-way Monte Carlo analysis was conducted to assess the impact of variations in medical costs, QoL, and mortality data. The analysis was carried out by putting a probabilistic distribution over the differences in the estimates observed in the two groups rather than on single values. Simulations were run 5,000 times. The range of variation was from 0 to twice as big.

**Estimated benefits used in the economic analysis**
Under the six scenarios considered, the estimated incremental LYs gained with the intensive programme relative to the standard programme ranged from 24 to 798 and the estimated incremental QALYs gained ranged from 6,578 to 126,224 in the 25-year model.

The estimated incremental LYs gained ranged from 477 to 10,785 and the estimated incremental QALYs gained ranged
from 17,232 to 388,001 in the 50-year model.

**Cost results**

Under the six scenarios considered, the estimated incremental costs associated with the intensive programme relative to the standard programme ranged from $3,963 to $3,006 in the 25-year model and from $5,818 to $1,645 in the 50-year model.

**Synthesis of costs and benefits**

An incremental cost-benefit (LYs or QALYs) ratio was calculated to synthesise costs and benefits of the intensive programme relative to the standard programme.

Under the six scenarios considered, the estimated incremental cost per LY gained ranged from $170,000,000 to $3,800,000 in the 25-year model and from $12,000,000 to $150,000 in the 50-year model.

The estimated incremental cost per QALY gained ranged from $600,000 to $24,000 in the 25-year model and from $340,000 to $4,900 in the 50-year model.

The sensitivity analysis suggested that in 99% of cases, the incremental costs of the programme would be between $1.5 billion and $6 billion after 50 years and uncertainty in incremental costs as well as in QALY gains increased over time.

There was a 92% chance that the incremental cost per QALY was below $50,000.

**Authors’ conclusions**

The authors concluded that the school-based anti-tobacco intensive programme was not cost-saving but offered a reasonable cost per QALY in comparison with standard educational practice in the USA. The cost per QALY was unfavourable only under very conservative scenarios. However, when improvements in quality of life were ignored (in the CEA), the intervention was no longer cost-effective.

**CRD COMMENTARY - Selection of comparators**

The rationale for the choice of the comparator was clear. The new intensive programme was compared with the educational practice currently used in the US setting, which basically means no intervention of any sort. A detailed description of the two alternatives would have been useful. The authors noted that a variety of educational programmes currently exist within the USA. You should decide whether it represents a valid comparator in your own setting.

**Validity of estimate of measure of effectiveness**

The effectiveness evidence came mainly from published studies but a systematic review of the literature was not conducted. Primary studies were identified selectively. The design of the studies was reported only in some instances. Effectiveness estimates were aggregated but the method used was not described. It was not clear whether the authors took into consideration differences across the studies when estimating the effectiveness. Regression analyses were performed to calculate some estimates from published data. The authors made some assumptions that were used in the decision model, and further data on QoL came from personal communications. Most of the estimates used in the model were not varied in the sensitivity analyses, which were conducted only on some parameters. These issues would reduce the internal validity of the effectiveness analysis. However, it has to be noted that the authors presented the results for different scenarios, thus several base-case analyses were conducted.

**Validity of estimate of measure of benefit**

The benefit measures were appropriate to estimate the impact of the programme on individual health. Both represent widely used summary measures and are comparable with the benefits of other health care interventions. QoL and mortality data were varied in the sensitivity analyses. However, the estimated benefits depended strongly on the model
inputs selected in the analysis. Such inputs were mainly based on historical data, which may vary when long-term projections are carried out.

Validity of estimate of costs
Although the authors stated that societal costs were considered, no indirect costs were included in the analysis although they could have been relevant due to the long-term time horizon. It may be difficult to replicate the economic analysis in other settings as few details were provided of unit costs and resource use data, and these were not provided separately. A breakdown of items considered in the estimation of medical care costs was not provided. Cost estimates were specific to the study setting and no statistical tests were conducted on baseline estimates. Sensitivity analyses were conducted in which the difference in total costs between the two groups was varied. Total costs can be reflated in other settings because the price year was reported.

Other issues
The authors did not compare their findings with those from other studies and did not address the issue of the generalisability of the study results. Thus the external validity of the analysis was low. Sensitivity analyses were conducted, not to generalise the results, but to address the robustness of the conclusions of the analysis. The authors noted some caveats of the analysis, which have been reported in the relevant fields above. In particular, it was stressed that the model did not take into account the implications of the reduced exposure to environmental tobacco smoke due to the efficacy of the programme. Further, the model did not differentiate individuals according to ethnicity.

Implications of the study
The study results suggest that a school-based intensive programme for tobacco use may be effective and efficient. The authors highlighted the importance of implementing other interventions aimed at reducing tobacco use.

Source of funding
The California Tobacco-Related Disease Research Program (Grant 6PT-3005) and the National Institute of Drug Abuse (PHS Grant DA 13332) supported this work.

Bibliographic details
Tengs T O, Osgood N D, Chen L L. The cost-effectiveness of intensive national school-based anti-tobacco education: results from the tobacco policy model. Preventive Medicine 2001; 33: 558-570

PubMedID
11716651

DOI
10.1006/pmed.2001.0922

Other publications of related interest


Indexing Status
Subject indexing assigned by NLM

MeSH
Adolescent; Adult; Child; Cost-Benefit Analysis; Demography; Female; Health Education /economics; Humans; Male; Models, Economic; Quality-Adjusted Life Years; Smoking /epidemiology /prevention & control; United States /epidemiology

AccessionNumber
22002008030

Date bibliographic record published
31/03/2004

Date abstract record published
31/03/2004