A model for cost-effectiveness analyses of smoking cessation interventions applied to a quit-and-win contest for mothers of small children

Johansson P M, Tillgren P E, Guldbrandsson K A, Lindholm L A

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 study evaluated the use of a tobacco cessation intervention for mothers of small children.

Type of intervention
Primary prevention.

Economic study type
Cost-utility analysis.

Study population
The study population comprised mothers with children aged 0 to 6 years who were daily smokers. No other inclusion criteria or exclusion criteria were reported in this paper.

Setting
The setting appears to have been primary care. The economic study was carried out in Sweden.

Dates to which data relate
The effectiveness data were gathered between 1987 and 2003. The resource use data were gathered between 1994 and 2001. The price year was 2000.

Source of effectiveness data
The effectiveness data were derived from a review of published studies.

Modelling
A Markov model was developed to estimate the incremental costs of the smoking cessation intervention, compared with the do-nothing option, using Data 3.5 software (Treeage Inc.). The health states of the model were lung cancer, chronic pulmonary disease (COPD), cardiovascular disease including coronary heart disease and stroke, and death. A probabilistic analysis was carried out using Monte Carlo simulation. Each cycle was 1 year long. The simulation terminated either at death or at age 85 years, except when costs in added years were considered in the analysis (a lifetime horizon was then used). Details of methods and parameters distributions were reported elsewhere (Johansson, see ‘Other Publications of Related Interest’ below for bibliographic details).

Outcomes assessed in the review
The main outcomes estimated from the review of the literature were the risks of disease and death associated with lung cancer, COPD and acute myocardial infarction (AMI) for both smokers and quitters. Age- and gender-specific disease
risks, conditional on smoking status and years since quitting, were used for the analysis.

**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**
Approximately 8 studies were included in the review.

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

**Investigation of differences between primary studies**
No differences between the primary studies were investigated.

**Results of the review**
The risk of developing a lung cancer was 0.12 (standard deviation, SD=0.33) for smokers and 0.01 (SD=0.10) for quitters.

The risk of developing COPD was 0.08 (SD=0.28) for smokers and 0.03 (SD=0.17) for quitters.

The risk of suffering an AMI was 0.05 (SD=0.22) for smokers and quitters.

For smokers, the risk of death associated with these conditions was 0.10 (SD=0.30) for lung cancer, and 0.03 (SD=0.17) for COPD and AMI.

For quitters, the risk of death associated with these conditions was 0.01 (SD=0.09) for lung cancer, 0.01 (SD=0.11) for COPD and 0.03 (SD=0.16) for AMI.

These data formed the principal effectiveness parameters used in the analysis. The authors only reported selected estimates for women aged 35 to 39, until the age of 85 years.

**Measure of benefits used in the economic analysis**
The outcome measures were life-years saved (LYS) and quality-adjusted life-years (QALYs). A variety of sources were used to obtain disease-related death risks for both quitters and smokers. For other causes of death, estimates from the Swedish National Death Registry estimates were used. The number of LYS was calculated until age 85 and predicted by the model. Utility values were taken from a Swedish representative population study, (Burstrom et al. 2001, see 'Other Publications of Related Interest' below for bibliographic details). The method of valuation was not reported in this
paper. The outcomes were discounted at a rate of 3%.

Direct costs
The direct costs reported were those of the health service. The key resource use categories included were initial disease-
specific medical treatment costs (i.e. those accumulated during 6 months after the assumed first admission to hospital),
annual disease-specific medical treatment costs, costs of death (i.e. those accumulated during 6 months before death),
and costs related to the intervention. The latter (intervention-related costs) included personnel, overheads, campaign
material and publicity, participant support measures and the prize ceremony. Resource use was not reported separately
from the costs. Discounting was carried out at a rate of 3%. The costing appears to have been based completely on
actual data. The price year was 2000.

Statistical analysis of costs
The costs were treated stochastically. The methods used for the statistical analysis of the costs were not reported in this
paper.

Indirect Costs
Indirect costs were also considered. The cost analysis included income loss because of absence from work and
morbidity productivity costs before the age of 65 years. Participant time spent attending the smoking cessation meetings
was also included. Resource use was not reported separately from the costs. Discounting was carried out at a rate of 3%.
The costing appears to have been based completely on actual data. The price year was 2000.

Currency
Swedish kroner (SEK). The conversion rate was Euro 1 = SEK 8.45.

Sensitivity analysis
Several univariate sensitivity analyses were performed. These varied all model parameters over a range of values
(+100% to -50%, approximately). Two sets of multivariate analyses were also performed. These varied the risk of
disease and death (high risk: death and disease risk +100%, risk fraction +0.1; low risk: death and disease risk -50%,
risk fraction -0.1). They also investigated the addition of an increment of +25% on all costs for the high-risk group and
a reduction of -25% on all costs for the low-risk group. The method used to select the ranges was not specifically stated,
but assumptions may have been the basis of the selection.

Estimated benefits used in the economic analysis
The model estimated that the difference between smokers and quitters was between 0.34 (age group 15 to 19 years) and
0.55 (age group 30 to 34 years) QALYs gained until the age of 85 years. The undiscounted LYS for smokers and
quitters differed by 1 to 2 years. The authors did not specify the incremental benefits of the intervention compared with
the control strategy.

Based on the results of the "Quit Smoking Gals" programme undertaken in one of the health care districts in Stockholm
County Council, 238 women were recruited, of whom 34 remained tobacco-free for 12 months. The number of LYS
was estimated to be 20, while the number of QALYs gained because of the intervention was 16.

Cost results
The total costs for a female smoker were estimated to be between SEK 100,000 and SEK 180,000, depending on age
group. For a quitter, these costs were between SEK 80,000 and SEK 150,000.

The cost analysis revealed the savings associated with smoking cessation amounted to about SEK 30,000 per female
quitter.
If disease-related morbidity productivity costs were excluded, the savings per quitter were approximately SEK 20,000.

The authors did not specify the incremental costs of the intervention compared with the control strategy.

Based on the results of the "Quit Smoking Gals" programme undertaken in one of the health care districts in Stockholm County Council, the intervention costs amounted to SEK 267,000, the cost per participant was SEK 1,100 and the cost per quitter was SEK 7,850. The cost per undiscounted LYS was SEK 4,100.

The "Quit Smoking Gals" intervention led to societal cost-savings of SEK 830,000. These savings ranged from SEK 2,620,000 to SEK 420,000 according to the discount rate.

**Synthesis of costs and benefits**

The sensitivity analysis showed that the parameter with the highest impact on the results was the discount rate.

The costs and benefits were not combined.

**Authors' conclusions**

The "Quit and Win" contest was associated with cost-savings and health gains.

**CRD COMMENTARY - Selection of comparators**

A do-nothing option was used as the comparator. This seems to have been appropriate for this type of analysis. You should decide whether this could be a valid comparator in your own setting.

**Validity of estimate of measure of effectiveness**

The effectiveness data were derived from a review of published studies, but a systematic review of the literature was not undertaken. Although this is common practice with models, it does not always ensure that the best data available are used in the model. Details of the primary studies and the methods used to combine the primary estimates were not provided. The effectiveness evaluation was designed as a before-and-after study, which, as the authors acknowledged, entails less scientific rigour than other evaluation designs. In addition, the authors did not justify their choice of the type of patient population (mothers with children aged 0 to 6 years who were daily smokers). Uncertainty around the outcome parameters was investigated in sensitivity analyses.

**Validity of estimate of measure of benefit**

The authors used the numbers of LYS and QALYs gained from smoking cessation intervention as their summary measures of health benefit. These measures represent natural outcomes from a preventive programme and enable comparisons with similar vaccination evaluations. The outcomes results were left disaggregated and no incremental benefits of the smoking cessation programme over the do-nothing approach were explicitly presented.

**Validity of estimate of costs**

The analysis of the costs was performed from a societal perspective. It appears that all the relevant categories of costs have been included. Although the costs were reported separately to other model parameters, they were presented in an aggregated manner. Details of the unit costs and the quantities of resources used were not given, which limits the transferability of the study results to other settings. The costs were treated deterministically and were not subjected to any statistical tests. All cost components were explored in the sensitivity analysis. No justification was given for the ranges used, and it was not possible to determine whether they were appropriate. The source of the cost data was reported for each item. The price year and conversion rate were reported, which will aid reflation exercises in other settings. Discounting was conducted and was relevant because of the long time horizon. No incremental costs of the smoking cessation programme compared with the do-nothing option were explicitly presented.
Other issues
Although the authors highlighted the relevance of conducting a cost-utility analysis using generic outcome measures, no incremental analysis (incremental cost-effectiveness ratios) was presented. The way in which the authors reported the mean costs and outcomes for the smoker and quitter status was confusing: one could assume these were equivalent to the intervention and control strategy, but it was not clear how the probability of quitting smoking after taking part in the "Quit-and-Win" contest was implemented in the model. The authors discussed the results of the analysis in the context of the published literature. The issue of generalisability to other settings was not addressed. Limitations reported by the authors included the potential underestimation of costs for diseases other than stroke, the overestimation of medical treatment costs, and the fact that true opportunity costs were not reflected because the administrative system was used to assess medical treatment costs.

Implications of the study
The authors stated that the model results show considerable health gains and cost-savings resulting from tobacco cessation among women. The authors highlighted that the construction of an optimal mix of tobacco control policies would demand economic evaluations of a wide range of tobacco control programmes.

Source of funding
None stated.

Bibliographic details

PubMedID
16265801

Other publications of related interest


Indexing Status
Subject indexing assigned by NLM

MeSH
Adult; Child, Preschool; Cost Savings; Cost-Benefit Analysis /methods; Female; Follow-Up Studies; Health Care Costs; Humans; Infant; Models, Economic; Mothers; Quality-Adjusted Life Years; Smoking Cessation /economics; Surveys and Questionnaires

AccessionNumber
22005007701

Date bibliographic record published
30/11/2006

Date abstract record published
30/11/2006