Cost-effectiveness of face-to-face smoking cessation interventions: a dynamic modeling study

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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 study compared five face-to-face smoking cessation interventions, managed by either medical professionals or educated smoking cessation counsellors, with current practice in the authors' setting. The five interventions were as follows:

- minimal counselling (MC) by a general practitioner (GP) and/or a GP-assistant in one or two consultations for a total length of 12 minutes;
- minimal GP counselling in combination with nicotine patches or gum (i.e. nicotine replacement therapy, NRT) for 8 weeks (MC+NRT);
- intensive counselling by a trained counsellor in combination with NRT for 12 weeks (IC+NRT); counselling was administered by a trained lung nurse for a total of 90 minutes plus a 2-minute stop advice for a lung physician;
- intensive counselling by a trained lung nurse, plus a 2-minute stop advice by a lung specialist, in combination with bupropion for 9 weeks (IC+Bupr); and
- telephone counselling (TC), comprising one intake call of 30 minutes and 6 follow-up calls of 15 minutes each, based on a computerised questionnaire completed by prospective quitters and administered according to the procedures followed by the Dutch Foundation on Smoking and Health (STIVORO).

The comparator chosen was current practice in the authors' setting. It included a mix of all available smoking cessation methods at the time of the study (including the five interventions mentioned above) and willpower alone.

Type of intervention
Primary prevention (smoking cessation interventions).

Economic study type
Cost-effectiveness analysis and cost-utility analysis.

Study population
The population modelled was the Dutch population, which was changed on an annual basis due to predicted demographic changes.

Setting
The setting was the community and primary care. The economic study was carried out in the Netherlands.

Dates to which data relate
The effectiveness data were derived from sources published between 1993 and 2003, while the resource use data were
derived from sources published between 2001 and 2003. The cost data were derived from sources published between 2001 and 2002. All costs were reported for the price year 2000.

Source of effectiveness data
The effectiveness data were derived from the STIVORO database and from a review and synthesis of published studies.

Modelling
The authors used a dynamic simulation model to evaluate possible gains in life-years, quality-adjusted life-years (QALYs), and the savings in health care costs that result from a decrease in the incidence of smoking-related diseases due to smoking cessation interventions. The main difference between this model and other models was that this model followed a changing population over time rather than following one cohort of people through time. The prevalence of smoking consisted of three states (never a smoker, current smoker and former smoker), and the cycle of each state equalled one year. The time horizon of the model was 75 years and the start year of the simulations was year 2000. The transition probabilities depended on gender, age and risk factor state (never, current or former smoker). Further details of the model are reported elsewhere (Hoogenveen et al. 1998 and 2000, and Feenstra et al. 2001; see Other Publications of Related Interest- below for bibliographic details).

Outcomes assessed in the review
The main effectiveness parameters found from the literature were the abstinence rates associated with the different interventions and the percentages of those taking a smoking cessation intervention who were taking the specific interventions. There were numerous other parameters that cannot be reported here.

Study designs and other criteria for inclusion in the review
Data were derived from cohort studies, international randomised controlled trials and Cochrane meta-analyses. No further criteria for inclusion in the review were 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
Not reported.

Number of primary studies included
Overall, the authors used 25 primary studies as sources of effectiveness data.

Methods of combining primary studies
No methods were reported. Data from the available studies do not seem to have been combined.

Investigation of differences between primary studies
It appears that differences between the primary studies have not been investigated.
Results of the review
The percentage of smokers using smoking cessation intervention, as a percentage of the total number of smokers in the country, was 0.026% for TC, 0.36% for MC, 0.66% for MC+NRT, 0.16% for IC+NRT and 0.14% for IC+Bupr.

The 12-month abstinence rates were 3.4% under current practice, 7.6% (95% confidence interval, CI: 6.9 to 8.3) with TC, 7.9% (95% CI: 4.7 to 11.1) with MC, 12.7% (95% CI: 11.9 to 13.5) with MC+NRT, 15.1% (95% CI: 14.1 to 16.1) with IC+NRT, 17.2% (95% CI: 14.0 to 20.4) with IC+Bupr.

Other outcomes ascertained from the literature were reported in full, but are too numerous to be reported here.

Measure of benefits used in the economic analysis
The authors used life-years gained and health utility (QALYs) as measures of benefit in the economic analysis. Both measures were derived from published literature, and the QALY weights used were reported.

Direct costs
The health service costs included in the analysis were for the five interventions. The cost of TC included counsellor time. The cost of MC covered GP time and self-help manuals. The cost of MC+NRT covered GP time, self-help manuals and prescriptions of NRT. The cost of IC+NRT covered chest physician time, lung cancer time and prescriptions of NRT per defined daily dose (DDD). The cost of IC+Bupr covered the chest physician, lung nurse time, and prescriptions of bupropion per DDD. Overhead costs and the cost of assistants were included and were accounted for in each intervention. It was reported that the costs of adverse effects were omitted as they were assumed to be insignificant. The costs and the quantities were reported separately. All quantities of resources used and all costs were derived from published sources and were reported for the price year 2000. As the time horizon of the model was 75 years, the costs were appropriately discounted.

Statistical analysis of costs
The costs were treated deterministically.

Indirect Costs
The indirect costs were not included in the economic analysis.

Currency
Euros (EUR).

Sensitivity analysis
The authors conducted various one-way sensitivity analyses to investigate the impact of variability in the data on the robustness of the results. The parameters tested in the sensitivity analyses were cessation rates, intervention costs, discount rates, time horizon and the percentage of smokers reached who take up an intervention. The 95% CI estimates of cessation rates, and the minimum and maximum prices of intervention costs derived from the literature, were tested in the sensitivity analysis. Different discount rates (0, 3 and 5%) were applied, and a two-way sensitivity analysis was conducted using a 4% discount rate for the costs and a 0% discount rate for the effects. The percentage of smokers that initiated an intervention was varied from 10 to 50% of all smokers. The time horizon was decreased to 20, 30 and 50 years.

Estimated benefits used in the economic analysis
When the intervention was implemented for 75 years, the cumulative discounted life-years gained were 31 x10^4 for TC, 33 x10^4 for MC, 62 x10^4 for MC+NRT, 74 x10^4 for IC+NRT, and 84 x10^4 for IC+Bupr. The cumulative discounted QALYs gained were 38 x10^4 for TC, 41 x10^4 for MC, 78 x10^4 for MC+NRT, 94 x10^4 for IC+NRT,
and $110 \times 10^4$ for IC+Bupr.

**Cost results**
For 75 years-implementation, the net value of the intervention at 2000 level prices was EUR $1.7 \times 10^9$ for TC, EUR $0.52 \times 10^9$ for MC, EUR $3.8 \times 10^9$ for MC+NRT, EUR $7.8 \times 10^9$ for IC+NRT, EUR $7.3 \times 10^9$ for IC+Bupr.

**Synthesis of costs and benefits**
The average cost-effectiveness ratios were calculated. For 75 years-implementation the cost per life-year gained was EUR 1,400 for TC, EUR 1,800 for MC+NRT, EUR 6,200 for IC+NRT, and EUR 4,300 for IC+Bupr. The cost per QALY gained was EUR 1,100 for TC, EUR 1,400 for MC+NRT, EUR 4,900 for IC+NRT, and EUR 3,400 for IC+Bupr.

Minimal GP counselling dominated all other interventions for every implementation period. Assuming 75 years-implementation, the MC intervention yielded 330,000 life-years and 410,000 QALYs, and resulted in cost-savings of EUR 1.4 billion. The cost-savings were higher than the intervention costs (EUR 520 million).

The sensitivity analyses demonstrated that the results were sensitive to changes in the effectiveness of the interventions (cessation rates), as they led to changes in the QALYs gained and incidence of smoking-related diseases and thus additional costs. The results were robust to variations in resources used, different time horizons tested, and the percentage of smokers that take up the intervention. The cost-effectiveness ratios were sensitive to different discount rates, with cost-effectiveness becoming less attractive as the discount rate increased.

**Authors' conclusions**
All five smoking cessation interventions were cost-effective in comparison with current practice. Minimal general practitioner (GP) counselling was even cost-saving.

**CRD COMMENTARY - Selection of comparators**
An explicit justification was given for the comparators used. They were interventions commonly used in the Netherlands. You should decide if this represents a widely used technology in your own setting.

**Validity of estimate of measure of effectiveness**
No systematic review of the literature was undertaken. Although this is common practice with models, it does not always ensure that the best data available are used in the model. The authors appear to have used data from the available studies selectively. Details of the model were described in separate studies making it difficult to comment on the methodology and conduct of the review. It appears that the authors did not consider the impact of differences between the studies identified when estimating effectiveness.

**Validity of estimate of measure of benefit**
The measures of benefit were the life-years gained and health utility (QALYs). These values were derived from the literature.

**Validity of estimate of costs**
The authors reported that the study had been conducted from a societal perspective. However, the indirect costs were not included. Although some costs were omitted from the analysis, their omission is unlikely to have affected the authors' conclusions. The costs and the quantities were reported separately, thus enhancing the reproducibility of the study to other settings. The quantities of resources used and costs were derived from published sources, and sensitivity analyses on the resources used and costs were conducted to assess the robustness of the estimates used. The ranges used appear to have been appropriate. As the costs were incurred for more than a 2-year period, discounting was
appropriately conducted. The price year was reported, which will aid any future reflation exercises.

**Other issues**
The authors compared their findings with those of published studies, reporting consistency in their findings. The issue of the generalisability of the results to other settings was not directly addressed. The authors do not appear to have presented their results selectively. The study enrolled individuals who were smokers and this was reflected in the authors' conclusions. The authors reported three possible limitations to their study which may have led to the cost-effectiveness ratios being overestimated. First, the estimates of effectiveness were derived from clinical trials without judging the study sample characteristics of the trials. Second, the model did not account for a delay effect of smoking cessation, resulting in greater reduction in the relative risk of smoking-related disease incidence. Finally, the analysis only accounted for smoking-related disease costs avoided and not for unrelated health care costs incurred as a result of life-years gained.

**Implications of the study**
The authors did not make any explicit recommendations for changes in policy or practice, nor for further research. However, their discussion highlighted some areas where more information is needed.

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**Other publications of related interest**


**Indexing Status**
Subject indexing assigned by NLM

**MeSH**
Adolescent; Adult; Aged; Bupropion /economics /therapeutic use; Child; Chronic Disease /economics /epidemiology; Cost of Illness; Cost-Benefit Analysis; Counseling /economics; Family Practice /economics /methods; Female; Health