Cost-effectiveness of pharmacological interventions for smoking cessation: a literature review and a decision analytic analysis

Song F, Raftery J, Aveyard P, Hyde C, Barton P, Woolacott N

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
Several interventions for smoking cessation were examined:

- simple advice or counselling only;
- advice or counselling plus nicotine replacement therapy (NRT);
- advice or counselling plus bupropion sustained release (BSR); and
- advice or counselling plus NRT and BSR.

Type of intervention
Treatment.

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

Study population
The study population referred to a hypothetical cohort of smokers.

Setting
The setting was primary care. The economic study was conducted in the UK.

Dates to which data relate
The effectiveness data were derived from studies published between 1994 and 2001. The dates during which the resource use data were collected were not reported. The price year was 2001.

Source of effectiveness data
The effectiveness evidence was derived from a review of completed studies.

Modelling
A decision analytic model, based on a standard decision tree, was constructed to assess the costs and benefits of the alternative strategies for smoking cessation. The model was populated with data derived from the literature. The simplified structure of the tree was depicted. The time horizon of the model was unclear, but only the short-term implications of the interventions were considered.
Outcomes assessed in the review
The outcomes assessed were:

the annual spontaneous cessation rate;
the quit rate at 12 months by advice and by counselling;
the odds ratio (OR) with NRT versus placebo;
the OR with BSR versus placebo;
the OR with NRT plus BSR versus placebo;
the lifetime relapse rate; and
the number of life-years saved (LYS) per long-term quitter.

Study designs and other criteria for inclusion in the review
Most of the primary studies were randomised clinical trials or systematic reviews. These were identified from the literature, although it was unclear how they were identified.

Sources searched to identify primary studies
Not stated.

Criteria used to ensure the validity of primary studies
The validity of the primary studies was implicitly ensured by the strong design (randomised trials or systematic reviews) of those selected.

Methods used to judge relevance and validity, and for extracting data
Not stated.

Number of primary studies included
Ten primary studies provided the evidence.

Methods of combining primary studies
The authors stated that the primary estimates were based on their assessment of published studies.

Investigation of differences between primary studies
Not stated.

Results of the review
The annual spontaneous cessation rate was 1% (range: 0.5 - 2).

The quit rate at 12 months was 4% (range: 3 - 5) by advice and 10% (range: 8 - 12) by counselling.

The OR was 1.67 (range: 1.55 - 1.80) with NRT versus placebo, 2.1 (range: 1.62 - 2.73) with BSR versus placebo, and 2.65 (range: 1.65 - 4.25) with NRT plus BSR versus placebo.
The lifetime relapse rate was 40% (range: 30 - 50).

The number of LYS per long-term quitter was 2 (range: 1 - 3).

**Measure of benefits used in the economic analysis**
The summary benefit measure used was the number of LYS associated with each smoking cessation strategy. The LYS were obtained from modelling. The role of discounting in the calculation of the LYS was unclear. Quality-adjusted life-years (QALYs) were also calculated on the basis of a ratio of 1.35 QALYs per LYS, which was derived from the literature.

**Direct costs**
Discounting was not relevant since the costs were incurred during less than 2 years. The unit costs and the quantities of resources used were not presented separately. The categories of costs considered in the analysis were the costs per attempt with each intervention. However, a detailed breakdown of the cost items was not provided. Clearly, the main categories of costs were physician and nurse visits, BSR and NRT. The cost/resource boundary of the UK NHS was adopted in the study. The costs were estimated on the assumption that not all motivated-to-stop smokers would receive the full course of treatment. The authors stated that more details on the cost analysis had been published elsewhere (Woolacott et al., see Other Publications of Related Interest). Other assumptions on resource use were made and were reported. The price year was 2001.

**Statistical analysis of costs**
The total costs were presented as mean values with ranges. No statistical tests were conducted to test the significance of differences in the estimated costs.

**Indirect Costs**
The indirect costs were not considered.

**Currency**
US dollars ($).

**Sensitivity analysis**
A sensitivity analysis was conducted to investigate the variability in the data. Optimistic and pessimistic scenarios were considered. The optimistic scenario considered higher values for effects and lower values for costs, while the pessimistic scenario considered lower values for effects and higher values for costs (extreme analysis).

**Estimated benefits used in the economic analysis**
The estimated LYS or QALYs for each smoking strategy were not reported.

**Cost results**
The total estimated costs for each smoking strategy were not reported. Only the costs per attempt for each strategy were reported as input parameters in the model.

The cost per attempt was:

$5.08 with advice only;

$108.72 with advice plus NRT;
$109.56 with advice plus BSR;
$207.23 with advice, NRT and BSR;
$50.76 with counselling only;
$148.44 with counselling plus NRT;
$149.27 with counselling plus BSR; and
$246.95 with counselling, NRT and BSR.

Synthesis of costs and benefits
An incremental cost-effectiveness ratio was calculated to combine the costs and benefits of the alternative strategies for smoking cessation. Ranges of values representing optimistic and pessimistic scenarios were calculated and reported.

In comparison with advice or counselling alone, the average incremental cost per LYS was:

$3,455 (range: 2,107 - 16,726) with advice plus NRT;
$2,150 (range: 1,182 - 14,535) with advice plus BSR;
$2,836 (range: 1,268 - 26,245) with advice, NRT and BSR;
$1,441 (range: 439 - 8,044) with counselling plus NRT;
$920 (range: 306 - 7,052) with counselling plus BSR; and
$1,282 (range: 507 - 11,817) with counselling, NRT and BSR.

The incremental cost per QALY was:

$2,559 or $1,067 for NRT relative to advice or counselling, respectively;
$1,593 or $681 for BSR over advice or counselling, respectively; and
$2,101 or $950 for NRT plus BSR relative to advice or counselling, respectively.

In comparison with advice or counselling plus NRT, the average incremental cost per LYS was $2,391 (range: 952 - 80,558) with advice, NRT and BSR, and $1,156 (range: 538 - 33,170) with counselling, NRT and BSR.

In comparison with advice or counselling plus BSR, the average incremental cost per LYS was $4,322 (range: 1,385 - 288,612) with advice, NRT and BSR, and $2,123 (range: 825 - 115,445) with counselling, NRT and BSR.

Authors' conclusions
All smoking cessation strategies provided a cost-effectiveness ratio comparable to accepted health care interventions. This conclusion held even when the most pessimistic scenario was considered. Bupropion sustained release (BSR) appeared slightly more cost-effective than nicotine replacement therapy (NRT), but this result should be treated with caution as the data available for bupropion were more limited than those for the evidence on NRT. Hence, some uncertainty remained on some estimates.

CRD COMMENTARY - Selection of comparators
The choice of the comparators appears to have been appropriate since it covered the whole range of possible strategies for smoking cessation. Brief advice or counselling were considered as the basic comparators because they represented
You should decide whether they are valid comparators in your own setting.

**Validity of estimate of measure of effectiveness**
The effectiveness evidence came from a completed study, but it was unclear whether a systematic review of the literature was undertaken. However, most of the primary studies were randomised trials or systematic reviews of clinical trials, which increased the internal validity of the estimates used in the model. Further, reasonable ranges of values were used for each input in the sensitivity analyses, in which optimistic and pessimistic scenarios were considered. This enhanced the robustness of the effect estimates.

**Validity of estimate of measure of benefit**
The use of LYS or QALYs as the summary benefit measures was appropriate because they captured the impact of the interventions on the patients’ health. In addition, this means that comparisons with the benefits of other health care interventions are possible. However, it was unclear whether discounting was applied as the LYS were derived from published studies. Further, the LYS were converted into QALYs using a published ratio, and details of the utility values were not reported. The estimated total LYS or QALYs were not given.

**Validity of estimate of costs**
The authors explicitly stated the perspective adopted in the study. As such, it appears that all the relevant costs have been included in the analysis. However, a detailed breakdown of the cost items included in each cost category was not reported. The main approach used to estimate the costs was based on a published study, thus limited information on the cost analysis was provided. Only the average costs per attempt were reported. The price year was reported, which will facilitate reflation exercises in other settings. The total costs were not reported.

**Other issues**
The authors compared their findings with those from other economic evaluations and similar results were obtained. These studies were found by searching MEDLINE and NHS EED. The results of these published references were reported in detail. The issue of the generalisability of the study results to other settings was implicitly addressed in the sensitivity analyses, in which wide ranges of cost and effect estimates were tested. This enhances the external validity of the analysis. The authors noted that the costs and health consequences of side effects associated with BSR were not considered. The inclusion of such aspects would favour NRT. The authors acknowledged some limitations to the validity of the whole analysis. First, the model considered only individuals who remained on one type of treatment, whilst in a real-world setting individuals usually switch from one method to another. Second, the results relied on assumptions based on different studies. Third, the infrastructure costs of smoking cessation programmes were not considered, which could have resulted in an underestimation of the intervention costs.

**Implications of the study**
The study results suggested that the addition of NRT or BSR to advice or counselling is a cost-effective strategy, as is combining NRT and BSR. However, the cost-effectiveness of adding NRT to BSR plus advice (or counselling), or adding BSR to NRT plus advice (or counselling) is less clear.

**Source of funding**
None stated.

**Bibliographic details**
Other publications of related interest

Indexing Status
Subject indexing assigned by NLM

MeSH
Bupropion /economics /therapeutic use; Combined Modality Therapy; Cost of Illness; Cost-Benefit Analysis; Counseling /economics /standards; Decision Support Techniques; Dopamine Uptake Inhibitors /economics /therapeutic use; Drug Costs /statistics & numerical data; Great Britain /epidemiology; Humans; Nicotine /economics /therapeutic use; Quality-Adjusted Life Years; Smoking /economics /mortality /prevention & control; Smoking Cessation /economics /methods; Treatment Outcome; Value of Life

AccessionNumber
22002008248

Date bibliographic record published
31/12/2004

Date abstract record published
31/12/2004