Cost-utility analysis of varenicline versus existing smoking cessation strategies using the BENESCO simulation model: application to a population of US adult smokers

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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.

CRD summary
The study investigated the cost-utility of the new smoking-cessation agent varenicline compared with other pharmacological options for smokers. The authors concluded that varenicline was a cost-effective treatment strategy in the USA and dominated the other options as it was more effective and less costly. In summary, the study methods were mostly transparent and the data were comprehensively analysed. The conclusions reached by the authors appear reasonable, given the analysis presented.

Type of economic evaluation
Cost-utility analysis

Study objective
The aim was to evaluate the cost-utility of varenicline, a new drug designed to aid smoking cessation.

Interventions
The study compared varenicline (an \( \alpha_4\beta_2 \) nicotinic acetylcholine receptor partial agonist) with other smoking-cessation strategies; namely, bupropion, nicotine replacement therapy (NRT) and unaided quitting. Varenicline was administered 1mg twice daily for 12 weeks, bupropion 150mg twice daily for 12 weeks and NRT was taken as gum, a patch or inhaled. The study population was a hypothetical US cohort of smokers stratified into males and females by age groups 18 to 34 years, 35 to 64 years and 65+ years who were assumed to take a one-time course of smoking-cessation treatment.

Location/setting
USA/primary care.

Methods
Analytical approach:
The analysis synthesised data from recent clinical trials and epidemiological evidence. A Markov model, named the BENESCO (Benefits of Smoking Cessation on Outcomes) model, was developed. It was based on the established Health and Economic consequences of Smoking (HECOS) model and included enhancements. The model covered different time durations (two, five, 10 and 20 years) and a lifetime horizon. The authors stated that the perspective was that of the US health care system.

Effectiveness data:
The clinical estimates included continuous abstinence rates at one year, numbers of smoking-related diseases (coronary heart disease, lung cancer, chronic obstructive pulmonary disease and asthma) and deaths. Evidence of abstinence rates were abstracted from two head-to-head clinical trials of varenicline, bupropion and placebo, a Cochrane review of NRT that included a meta-analysis and epidemiological evidence of disease incidence.

Monetary benefit and utility valuations:
Utility valuations were based on a cost-effectiveness study that provided values by sex- and age-bands for individuals without smoking-related morbidity (Fiscella et al. 1996, see Other Publications of Related Interest for bibliographic details) and from eight published studies for individuals with smoking diseases.
Measure of benefit:
The measure of benefit used was quality-adjusted life years (QALYs) discounted at 3% per annum.

Cost data:
Direct medical costs were included in the analysis. The cost categories comprised drugs, dispensing fees, physician fees and treatment costs of subsequent smoking-related diseases. Drug costs were obtained from the US Red Book. A weighted average cost was used for NRT based on established US market shares of these options. Resource quantities and unit costs for the smoking-cessation treatments and annual costs for smoking diseases were presented and referenced. Costs were provided in US dollars ($) for the year 2005, inflated when necessary (index not stated) and discounted at 3% per annum.

Analysis of uncertainty:
Parameter uncertainty was addressed using one-way sensitivity analyses of the key variables (costs, efficacy rates, relapse rates, disease incidence, prevalence and mortality rates). Results were illustrated in a tornado plot. Probabilistic sensitivity analyses were performed and the results were provided in the text.

Results
For the US health system and a cohort of 11.9 million smokers, the total costs for varenicline were $328,541 million over a lifetime compared with $330,958 for bupropion, $332,662 for NRT and $333,283 for unaided cessation. The corresponding QALYs attributed to varenicline were 174.3 million compared with 173.9 million for both bupropion and NRT and 173.4 million for unaided cessation. Varenicline dominated all other options as it produced higher QALYs (was more effective) and was less costly.

When the cohort age was 65 years or over, the incremental cost-effectiveness ratios were $16,255 per QALY for varenicline versus bupropion and $25,865 per QALY versus unaided cessation.

Sensitivity analyses showed that the base-case analysis results were most sensitive to baseline utilities, cost of varenicline and bupropion and discount rate. The probability that varenicline was dominant was 68.8% against bupropion, 77.2% against NRT and 79% against unaided cessation.

Authors' conclusions
The authors concluded that varenicline was a cost-effective alternative to the currently available pharmacological options for smoking cessation and should be considered for public reimbursement.

CRD commentary
Interventions:
The smoking-cessation strategies were described clearly and in detail. The reader should decide if these options are suitable and relevant in their own setting.

Effectiveness/benefits:
The effectiveness data were derived from recent clinical trials and included graded-down estimates of relapse rates over the longer term. The authors did not report confidence intervals around the bupropion and varenicline treatment effects. As only brief details of the trials were provided, readers are referred to these trials and the reviews for an assessment on the validity of the clinical endpoints used in their model. Utility values for smokers without smoking morbidities were based on a study nearly 20 years old and may be outdated (presumably these values were used to capture the age and gender bands necessary for the model). The instruments or methods used for deriving utility scores were not reported.

Costs:
Direct medical costs were included in the analysis and appeared appropriate to the perspective used. It was unclear whether costs for side-effects of these pharmacotherapies would have altered the results; this omission may represent a limitation of the analysis. The sources of resource use, quantities of drug use and unit costs were clearly presented. Details of the cost distributions used for the probabilistic sensitivity analyses were provided.

Analysis and results:
The cost and effect analyses were appropriate and incremental cost-effectiveness ratios were calculated. The results and sensitivity analyses were reported fully and cumulative cost and effect results were tabled. The authors discussed some limitations of the study. These included use of relative risks for mortality as proxies for relative risks for disease prevalence/incidence (in the absence of direct evidence) and the narrow cost perspective taken.

Concluding remarks:
Despite some minor limitations with data transparency, the analytical approach and methods of the study were comprehensive and appropriate. The conclusions reached by the authors appeared to reflect the scope of the analysis performed.

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Bibliographic details

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18489200

Other publications of related interest
Fiscella K et al. Cost effectiveness of the transdermal nicotine patch as an adjunct to physicians’ smoking cessation counselling. JAMA 1996; 1247-1251.

Indexing Status
Subject indexing assigned by NLM

MeSH
Adolescent; Adult; Benzazepines /economics /therapeutic use; Bupropion /economics /therapeutic use; Costs and Cost Analysis; Drug Costs; Female; Humans; Male; Markov Chains; Middle Aged; Models, Statistical; Nicotine /administration & dosage /economics; Quinoxalines /economics /therapeutic use; Smoking /adverse effects; Smoking Cessation /economics /methods /statistics & numerical data; United States; Varenicline

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