Cost-effectiveness of the clinical practice recommendations in the AHCPR guideline for smoking cessation

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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 evaluated 5 different counselling options/interventions that a patient might use in order to quit smoking: Minimal; Brief; Full; Individual Intensive; and Group Intensive. Each of the 5 counselling options was modelled with three further interventions: without nicotine replacement; with transdermal nicotine patch; and with nicotine gum. Thus in total 15 smoking cessation interventions were analysed. These were components of a published smoking cessation clinical practice guideline. The guideline recommends that health professionals screen all adult patients for smoking when they present to their physician, or are admitted to hospital as an inpatient for any reason. All patients identified as smokers were given initial advice on smoking cessation. Those smokers willing to quit then choose one of the 15 interventions outlined above. The cost effectiveness of implementing the overall guideline was also evaluated. The implicit comparator for the individual interventions and the guideline was no intervention.

Type of intervention
Treatment.

Economic study type
Cost-effectiveness analysis.

Study population
The study population for the guideline consisted of all smokers aged 18 and over in the United States (25% of the population), who presented to their physician or who were admitted to hospital as an inpatient for any reason. The study population for the individual interventions within the guideline was adult smokers who were willing to attempt to quit in the following 12 month time period. No information about the socio-demographic, economic or clinical characteristics of the study population was reported.

Setting
The setting was primary and secondary care in the USA.

Dates to which data relate
Effectiveness and resource data were collected from studies published between 1989 and 1997. The cost data were collected from studies and statistics published between 1992 and 1996. The price year was 1995.

Source of effectiveness data
The effectiveness data were taken from previously published studies.

Modelling
A decision analytical framework was used to determine the cost-effectiveness of the smoking cessation interventions. A
Outcomes assessed in the review
The outcomes assessed by the authors for use in the model to evaluate the individual interventions were as follows:

The incremental quit rate for each intervention (compared to the baseline quit rate reported in the meta-analyses of clinical evaluations);

(a) the underlying 3 month or more quit rate of all smokers in the USA;

(b) the relapse rate over 12 months;

(c) the number of life years saved by quitting smoking;

(d) the number of quality-adjusted life years saved by quitting smoking.

The model to evaluate the cost-effectiveness of the clinical guideline also included:

(e) the proportion of the US adult population who smoke;

(f) the proportion of smokers willing to attempt to quit smoking;

(g) the probability that a specific intervention would be used by smokers willing to attempt to quit smoking.

Study designs and other criteria for inclusion in the review
The quit rates and odds ratios for the individual interventions compared to baseline were estimated from the data reported in the clinical guideline. The authors reported that these data were derived by meta-analyses, using logistic fixed or random effects models. The studies used in the meta-analyses were peer reviewed, published, clinical trials with a minimum of 5 months follow-up. The authors reported that studies were screened to ensure methodological rigour, and studies including the same intervention were grouped together for analysis. These data were supplemented by population statistics, prospective studies and survey data to derive estimates for outcomes (b) to (g) above.

Sources searched to identify primary studies
The authors did not report the sources searched to identify literature for the effectiveness estimates.

Criteria used to ensure the validity of primary studies
The authors did not report the criteria used to assess the validity of the studies used to derive the effectiveness estimates.

Methods used to judge relevance and validity, and for extracting data
The authors did not report the criteria used to judge the validity of studies or to extract data for the estimates of effectiveness.

Number of primary studies included
The authors used data from 7 published sources. Of these 1 was the clinical guideline with its meta-analyses, 2 were reports of population statistics, 1 was a review of prospective studies, and 1 was a cost-effectiveness analysis. The design of the remaining 2 studies was not reported by the authors or defined by the references. The authors reported that the data drawn from the cost-effectiveness analysis were based on 4 studies reporting population statistics and surveys of mortality ratios, life expectancy and quality of life weights for smokers and non-smokers.
Methods of combining primary studies
The authors estimated the odds ratios for combinations of treatments (e.g. counselling plus pharmacological therapy) by multiplying the odds ratios of the quit rates of each intervention included in the combination. The quit rate of the population of adult US smokers was converted into an odds ratio. The authors then multiplied the odds ratios of quitting of the individual interventions specified in the guideline and the population of adult US smokers. The resulting estimate was converted back into a percentage quit rate. The quit rate of the population of adult US smokers was subtracted, to derive the incremental quit rate associated with each intervention. The life years and quality-adjusted life years saved were estimated as weighted averages by applying age and sex specific values from 1 study to the age and sex distribution of the US adult population of smokers. The authors did not report whether the estimates of the other effectiveness variables were based on single sources of data or combined from several sources, or the methods used to combine data from more than 1 source.

Investigation of differences between primary studies
The authors reported that the meta-analyses generated high quit rates in the control groups compared to the US population of adult smokers. They suggested that this was due to studies only enrolling participants who wanted to quit, and provision of low intensity cessation interventions to control participants. The authors adjusted the quit rates from the meta-analyses for the difference in baseline quit rates (see above). The authors did not report whether differences between the other studies used were investigated.

Results of the review
The results of the review were:

(a) The average "no intervention" quit rates (reported in the meta-analyses of clinical evaluations) were: 8.8% versus 10.7% for minimal counselling, 12.1% for brief counselling, and 18.7% for full counselling lasting more than 10 minutes (all excluding pharmacotherapy). The baseline quit rate for intensive counselling (4 - 7 sessions) was 10.4%, and the intervention quit rate for intensive counselling was 22.6%.

(b) The odds ratios for nicotine gum replacement therapy and transdermal patch compared to counselling alone (reported in the meta-analyses of clinical evaluations) were 1.4 - 1.6 and 2.1 - 2.6 respectively;

(c) The underlying 3 month or more quit rate of all smokers in the USA was 5%;

(d) The relapse rate over 12 months was 45%;

(e) The number of life years saved by quitting smoking was 1.46 per person;

(f) The number of quality-adjusted life years saved by quitting smoking was 1.97 per person.

(g) The proportion of the US adult population who smoke was 25%;

(h) The proportion of smokers willing to attempt to quit smoking was 75%;

Methods used to derive estimates of effectiveness
The probability that a specific intervention would be chosen by smokers (outcome (h)) was based on the expert opinion of the clinical guideline panel. It is not clear whether this was reported in the guideline or came from additional work undertaken by the authors of this study.

Estimates of effectiveness and key assumptions
The probability that a specific intervention would be used by smokers willing to attempt to quit smoking was:

(a) 25% minimal for counselling;
(b) 40% for brief counselling;
(c) 30% for full counselling;
(d) 2.5% for intensive individual counselling;
(e) 2.5% for intensive group counselling;
(f) 75% for counselling plus pharmacotherapy (83% patch, 17% gum).

Measure of benefits used in the economic analysis
The measure of benefit used in the economic analysis was quality-adjusted life years saved. The valuation of health states was derived from a published cost-effectiveness analysis, which constructed an index of health life years using data from a health survey of the US population. No other details about the source, date, study sample, or valuation methods were reported.

Direct costs
The direct costs included the costs of primary health care, smoking cessation specialists and pharmacy to identify patients and provide smoking cessation interventions. No other medical or non-medical direct costs were included. The cost items were:

(a) Screen all adult patients having a physician office visit or hospital inpatient admission for smoking status;
(b) Advise adult smokers to quit smoking;
(c) Motivate adult smokers to quit;
(d) Minimal counselling without nicotine replacement;
(e) Minimal counselling with nicotine transdermal patch;
(f) Minimal counselling with nicotine gum;
(g) Brief counselling without nicotine replacement;
(h) Brief counselling with nicotine transdermal patch;
(i) Brief counselling with nicotine gum;
(j) Full counselling without nicotine replacement;
(k) Full counselling with nicotine transdermal patch;
(l) Full counselling with nicotine gum;
(m) Intensive counselling without nicotine replacement;
(n) Intensive counselling with nicotine transdermal patch;
(o) Intensive counselling with nicotine gum;

The authors reported resource use and unit costs separately. The time inputs for health care professionals were based on resource inputs recommended in the guideline rather than patient data. The quantity of nicotine replacement therapy was based on the duration and dosages recommended in the guideline. The unit costs of physician time were estimated from Medicare allowed charges for 1994; the unit costs of registered nurse and psychologist time were estimated from...
mean weekly earnings for 1995 published by the US Bureau of Labor Statistics. To account for fringe benefits and overhead costs, the authors doubled the salary costs of these staff. The cost of nicotine replacement therapy was estimated from average wholesale prices in 1995. The costs were presented in 1995 prices. A medical services inflation index was used to adjust physician costs to a common year. The cost of educational printed materials was based on assumptions. The direct costs were for events within a 1 year timeframe and so were not discounted.

**Indirect Costs**
The monetary value of productivity losses and intangible outcomes associated with loss of life and/or poor health states due to smoking or adverse consequences of the interventions were not included.

**Currency**
US dollars ($). No currency conversions were reported.

**Sensitivity analysis**
One way sensitivity analysis was conducted to test the robustness of the results to uncertainty about the values assigned to the following parameters:

(a) Risk of relapse;

(b) Discount rate for benefits;

(c) Proportion of smokers willing to attempt to quit;

(d) Baseline probability of quitting for 3 months or more;

(e) Direct costs of patient time for travel and participation in the interventions.

**Estimated benefits used in the economic analysis**
The expected incremental discounted (3% discount rate) lifetime QALYs of the interventions, compared to no intervention, for all US adult patients screened for smoking status were:

(a) Minimal counselling without nicotine replacement, $373,000 willing smokers, $23,000 all adult patients;

(b) Minimal counselling with nicotine transdermal patch, $2,658,000 willing smokers, $415,000 all adult patients;

(c) Minimal counselling with nicotine gum, $1,448,000 willing smokers, $45,000 all adult patients;

(d) Brief counselling without nicotine replacement, $738,000 willing smokers, $74,000 all adult patients;

(e) Brief counselling with nicotine transdermal patch, $3,333,000 willing smokers, $833,000 all adult patients;

(f) Brief counselling with nicotine gum, $1,964,000 willing smokers, $98,000 all adult patients;

(g) Full counselling without nicotine replacement, $2,460,000 willing smokers, $184,000 all adult patients;

(h) Full counselling with nicotine transdermal patch, $6,348,000 willing smokers, 1,190,000 all adult patients;

(i) Full counselling with nicotine gum, $4,325,000 willing smokers, $162,000 all adult patients;

(j) Intensive counselling without nicotine replacement, $2,627,000 willing smokers, $16,000 all adult patients;

(k) Intensive counselling with nicotine transdermal patch, $6,602,000 willing smokers, $103,000 all adult patients;
Intensive counselling with nicotine gum, $4,563,000 willing smokers, $14,000 all adult patients;

Combined intervention (overall guideline), $3,294,000 willing smokers, $3,294,000 all adult patients;

**Cost results**
The expected incremental one year direct costs of the interventions, compared to no intervention, for smokers willing to attempt to quit were not reported. The expected incremental one year direct costs of the interventions, compared to no intervention, for all US adult patients screened for smoking status were:

(a) Minimal counselling without nicotine replacement, $93,579,000;

b) Minimal counselling with nicotine transdermal patch, $998,787,000;

c) Minimal counselling with nicotine gum, $205,551,000;

d) Brief counselling without nicotine replacement, $234,730,000;

e) Brief counselling with nicotine transdermal patch, $1,766,540,000;

f) Brief counselling with nicotine gum, $335,782,000;

(g) Full counselling without nicotine replacement, $279,425,000;

(h) Full counselling with nicotine transdermal patch, $1,637,972,000;

(i) Full counselling with nicotine gum, $348,209,000;

(j) Intensive counselling without nicotine replacement, individual, $29,908,000, group, $18,186,000;

(k) Intensive counselling with nicotine transdermal patch, individual, $150075000, group, $120769000;

(l) Intensive counselling with nicotine gum, individual, $31,843,000, group, $25,981,000;

(m) Combined intervention (overall guideline), $6,307,337,000.

These costs exclude long term medical costs associated with smoking, repeat interventions for those who failed to quit, and non-medical direct costs.

**Synthesis of costs and benefits**
The expected incremental cost per QALY gained of the interventions, compared to no intervention, for all US adult patients screened for smoking status was $1,915 for the overall guideline. The incremental costs per QALY gained were not reported for the individual interventions. The expected incremental costs per QALY gained of the interventions, compared to no intervention, for smokers willing to attempt to quit were:

(a) Minimal counselling without nicotine replacement, $4,015;

(b) Minimal counselling with nicotine transdermal patch, $2,405;

(c) Minimal counselling with nicotine gum, $4,542;

(d) Brief counselling without nicotine replacement, $3,181;

(e) Brief counselling with nicotine transdermal patch, $2,120;

(f) Brief counselling with nicotine gum, $3,725;
(g) Full counselling without nicotine replacement, $1,515;

(h) Full counselling with nicotine transdermal patch, $1,376;

(i) Full counselling with nicotine gum, $2,147;

(j) Intensive counselling without nicotine replacement, individual, $1,822, group, $1,108;

(k) Intensive counselling with nicotine transdermal patch, individual, $1,455, group, $1,171;

(l) Intensive counselling with nicotine gum, individual, $2,233, group, $1,822.

The QALYs were discounted at 3%, and costs were not discounted. The incremental cost per QALY saved was reported by the authors to be sensitive to varying the discount rate for benefits between 0% and 5% ($745-$3,205, overall guideline, all patients). Group intensive therapy without nicotine replacement therapy for willing smokers was sensitive to the inclusion of patient costs rising from $1,108 to $3,446. In this analysis group intensive therapy switched from a lower cost per QALY than full counselling to a higher cost per QALY ($3,446 intensive versus $1,975 full counselling).

**Authors’ conclusions**
The authors concluded that the a smoking cessation clinical practice guideline is cost-effective compared to most other medical interventions.

**CRD COMMENTARY - Selection of comparators**
The authors did not explicitly define or justify the comparator against which the cost-effectiveness of the interventions was evaluated. Implicitly, the interventions were each compared to no intervention, the implied justification being that, in the USA, physicians and other health care professional fail to assess and counsel smokers to quit smoking. If this is the case, then the comparator for the overall guideline may represent current health care practice for those physician office visits and inpatient admissions for any reason, where patients are not screened for smoking status or smokers advised to give up smoking. To assess the cost-effectiveness of interventions for smokers willing to give up smoking, you, as a user of this database, should consider whether no intervention reflects current health care practice in your own setting. In particular, if the decision for this group of smokers is which intervention to use, then the interventions should have been compared to each other, rather than to no intervention.

**Validity of estimate of measure of effectiveness**
The effectiveness data were estimated from published literature and statistics and expert opinion. The authors did not report whether the published meta-analyses used in this study were derived from a systematic search and review of published literature to identify relevant research and minimise bias. The authors indicated that the underlying rate of quitters in the trials (patients receiving no defined intervention) was higher than in the general population. The authors appropriately applied the reported odds ratios (from the meta-analyses) of smokers quitting with an intervention to a population rate of smokers quitting (with no defined intervention) to extrapolate the trial data to the general population. The authors acknowledged that the assumption that the marginal rate of quitting would be the same for all smokers was a necessary limitation, due to lack of data to derive population sub groups. They also implicitly assumed that the marginal rate of quitters would be the same in the trial setting and in routine practice. If the patients enrolled in clinical trials are atypical, receive additional motivation or are more compliant, this assumption may over estimate the marginal quit rate and benefits of the intervention in the general population.

The authors did not report whether they derived other estimates of effectiveness used as inputs to the model from selected studies, or combined all estimates found for each variable.

**Validity of estimate of measure of benefit**
The authors used quality-adjusted life years as the measure of benefit for the model. This was estimated from a published cost-effectiveness analysis of smoking cessation. The quality adjustment weight of not smoking was
originally derived from the National Health Interview Survey in the USA. The authors did not report details about the items used from the survey or the methods used to derive a quality adjustment weight. It is not possible to assess whether the weight used is a utility measure that reflects respondents’ values for preferred health states or ranking of preferences for health states.

Validity of estimate of costs
The direct medical costs of care for ill health due to smoking or adverse consequences of smoking cessation were not included. The authors noted that non-smokers (e.g. quitters) may have lower annual medical costs due to fewer episodes of ill health per year of life, but higher costs overall due to prolonged survival. This suggests that the cost estimates may be biased in favour of smoking cessation interventions. This may be an important omission given the inclusion of long term health gains. However, the authors also referred to other published studies that indicated that this omission is conservative and biases the cost analysis against smoking cessation interventions. Patient direct costs were not included; sensitivity analysis indicated that the overall results were not sensitive to these. Indirect costs of productivity losses and intangibles due to mortality and ill health as a result of smoking or adverse events were not included. However, the authors did include mortality and morbidity effects in the denominator of the incremental cost-effectiveness ratio (QALY). Inclusion of the monetary values of lost productivity and intangible outcomes in the cost-effectiveness ratio would not be appropriate if the QALY measure included the value of some or all of these mortality and morbidity consequences.

The authors presented resource use, prices and costs separately. Resource use was based on recommended levels from the clinical guideline and on an assumption, rather than patient data. This may be appropriate to assess the cost-effectiveness of the guideline implemented as recommended. It is not appropriate to assess the cost-effectiveness of the guideline in routine practice if it is not implemented according to the recommendations. The robustness of the cost data was not assessed by statistical or sensitivity analyses. The authors used Medicare allowed charges to proxy the cost of physician time. It was assumed that the lower rates paid by insurers, such as Medicare, reflect marginal costs more accurately. All costs were reported in 1995 prices.

Other issues
The authors noted that the model only reflects the costs and consequences of implementing the guideline for 1 year and that it is not clear how the success of the interventions would change over subsequent years. In addition, the authors assumed that smokers will only make one quit attempt per year. If those who fail have a subsequent physician office visit (average 3.25 per year, all reasons), or inpatient admission in that year, they should, according to the guideline, be encouraged to attempt to quit again in the same year. It is not clear how relaxation of this assumption would affect the results.

The authors compared their findings with other studies of smoking and smoking cessation, and to the cost-effectiveness of other interventions. These comparisons suggested that the results are robust. The model and analyses were designed to assess the costs and consequences of the guideline and interventions when used on the general population of the USA. However, assessment of the generalisability of the results is restricted by the limited description of the population, comparator, costing and benefit measurement and valuation methods used.

Implications of the study
The authors recommended that all the interventions included in the guideline should be promoted for use.

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None stated.

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