A simulation model of policies directed at treating tobacco use and dependence

Levy D T, Friend K

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
Two policies directed at treating smoking dependence were examined. One policy covered the costs of different combinations of treatment, while the other required health care providers to conduct brief interventions. Different smoking treatment strategies were also considered:

- minimal intervention or self-quitting (pamphlets, cutting down, and so on);
- prescription (Rx) pharmacotherapy (PT) alone;
- over-the-counter (OTC) PT alone;
- behavioural therapy (BT) alone;
- Rx, PT and BT in combination; and
- OTC, PT and BT in combination.

Type of intervention
Treatment.

Economic study type
Cost-effectiveness analysis.

Study population
The study population comprised a hypothetical cohort of smokers.

Setting
The setting was primary care. The economic study was carried out in the USA.

Dates to which data relate
The effectiveness data were derived from studies published between 1989 and 2000. The costs and resource use data were obtained from sources published from 1991 to 2000. The price year appears to have been 2000.

Source of effectiveness data
The effectiveness evidence was derived from a synthesis of completed studies and authors' assumptions.

Modelling
A computer simulation model of tobacco treatment policies (TTPs) was presented to show the impact of the different
smoking treatment strategies on quit rates, and to estimate the cost-effectiveness of the alternative options examined in the analysis. The model considered two types of treatment payment policies:

- access to treatment (that directly affect treatment use through increased coverage) and
- brief intervention (that provide additional information and are targeted toward increasing the number of quit attempts).

The model was built on a basic model of the quit decision in the absence of policy changes. The three parameters that mainly influenced smoking cessation were the annual quit attempt rate, the percentage of quitters using a treatment, and the average effectiveness of that treatment. The TTP model estimated the impact of the alternative policies on these parameters. A detailed description of all factors influencing the quit rates was given. For example, in the case of the access policy, the coverage of some treatments increased the annual quit attempt rate and the percentage of quitters using those treatments, thus simultaneously influencing the effectiveness of the treatments (because smokers attempting to quit smoking mainly for economic reasons might be less motivated) or the rate of substitution among treatments. The time horizon of the model was one year. A simplified structure of the decision tree used in the model was reported.

**Outcomes assessed in the review**

The outcomes estimated from the literature were:

- the base quit rate for minimal intervention, either BT or PT, and BT-PT combined;
- the median number of attempts for those who made a quit attempt;
- the final quit rates (adjusted to reflect multiple quit attempts);
- the patterns of treatment use;
- the proportion of smokers attempting to quit each year;
- the impact of access policies on treatment usage;
- the proportions of new quitters and quitters previously using other types of treatment;
- substitution across treatments due to different coverage policies;
- the proportion of smokers seeing a physician in one year;
- the proportion of physicians providing brief interventions; and
- the increase in quit rates due to brief intervention.

**Study designs and other criteria for inclusion in the review**

It was unclear whether a systematic review of the literature was undertaken. The primary studies appear to have been identified selectively. No information on the design of the studies was provided.

**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
Twenty-nine studies provided evidence.

Methods of combining primary studies
In general, a narrative method appears to have been used to combine the primary estimates. More weight was given to recent studies.

Investigation of differences between primary studies
Not stated.

Results of the review
The base quit rate was 5% for minimal intervention, 10% for either BT or PT (both Rx and OTC) and 20% for BT-PT (both Rx and OTC) combined.

The median number of attempts of those who made a quit attempt in one year was 2.

The final quit rates (adjusted to reflect multiple quit attempts) were 8% for unassisted quitting, 13% for Rx-PT, OTC-PT and BT, and 20% for combined PT-BT.

In terms of patterns of treatment use, 8% of attempted quits involved Rx-PT (2% with BT and 6% without BT), 15% involved OTC-PT (12% alone and 3% with BT), and 8% used BT (2% alone, 3% with Rx-PT and 3% with OTC-PT). It was estimated that 25% of PT users also used BT.

The proportion of smokers attempting to quit each year was 45%.

In terms of the impact of access policies on treatment use, Rx-PT coverage was estimated to increase use by 140%, while coverage of all PTs increased use by 90%. BT coverage was estimated to increase use by 70%. The coverage of combined Rx-PT and BT increased use by 180%, while the flexible option (coverage of all treatment strategies) increased treatment use by 120%.

The proportions of new quitters and quitters previously using other types of treatment (and that change treatment because of a different coverage policy) were 50% for all treatments but BT alone, and 50% for BT combined with Rx-PT. For BT coverage, 40% was from new quitters. For BT and Rx-PT combined, 60% was from new quitters.

For the flexible option, all of the substitution was from self-quitters. For the policy covering Rx-PT, 20% of substitution was from OTC-PT, 15% from OTC-PT with BT, and 5% from BT. For the policy covering all PT, 20% of substitution was from BT. For BT coverage, 10% each were from Rx-PT and OTC-PT. For combined Rx-PT and BT, 10% each were from OTC-PT and BT.

The proportion of smokers seeing a physician in one year was 70%.

The proportion of physicians providing brief interventions was 60%.

The increase in quit rates due to brief intervention was 30%.

Methods used to derive estimates of effectiveness
The authors made some assumptions that were used in the decision model. An expert panel was also consulted.
Estimates of effectiveness and key assumptions
The coverage elasticity was the same for each of the treatments affected by a policy and was invariant to the percentage of the population already covered.

Effectiveness was assumed to decline with the number of new treatment users.

Treatment effectiveness generally fell 10% as treatment use doubled for all treatment categories, except for combined PT and BT, for which a 20% reduction was estimated.

The average effectiveness of the brief intervention was set at 20% (30% in the literature) because it was assumed that the effect of this policy on new population may differ from that of smokers attempting to quit before the policy change.

Measure of benefits used in the economic analysis
The summary benefit measure used was the predicted quit rate, with and without tobacco use policies. It was derived from the decision model. Given the short time horizon, no discount rate was applied.

Direct costs
Discounting was not relevant since the costs were incurred during a short timeframe. The unit costs were not presented separately from the quantities of resources used. The economic evaluation comprised only the costs of the treatments examined in the study, including doctor and time costs, which were not clearly defined. The cost/resource boundary of the study was that of the service provider. Resource use and prices were estimated from published studies. Some assumptions on resource use and reimbursement policies were also made. The price year appears to have been 2000.

Statistical analysis of costs
The costs were treated deterministically.

Indirect Costs
The indirect costs were not considered in the economic evaluation.

Currency
US dollars ($).

Sensitivity analysis
Sensitivity analyses were carried out to examine the robustness of the benefit measure to variations in several model inputs. The parameters varied included treatment use, the return in effectiveness of treatments and the rate of substitution among treatments. Alternative ranges of values were, in general, derived from the literature or were set by the authors. Some alternative scenarios for the costs were also considered.

Estimated benefits used in the economic analysis
The predicted population quit rate in the absence of TTPs was 4.5%.

Assuming full prior coverage (or assuming full coverage with brief intervention), the effect of the TTPs in terms of the percentage increase in the population quit rate from its baseline level was 9% (or 16.3%) with coverage of Rx-PT only, 13.5% (or 21.1%) with all PTs, 4.4% (or 11.4%) with BT only, 13.6% (or 21.2%) with BT and Rx-PT, and 19.8% (or 27.8%) with the flexible policy. The increase in the quit rate for the brief intervention alone (no access treatment policies) was 6.7%. A slightly higher percentage of quit rates was observed when assuming no prior coverage.

Sensitivity analyses were performed in which treatment use, the return in effectiveness of the treatments and the rate of substitution, were varied. In the best-case scenario, the increase in quit rate when compared with no policies ranged
from 43.8% for Rx-PT alone to 105.7% for the flexible policy.

Overall, the incremental quits per smoker were 0.0048 with a policy covering Rx-PT only, 0.0076 with all PTs, 0.0026 with BT alone, 0.0080 with BT and Rx-PT, 0.0128 with a flexible policy, and 0.0030 with brief intervention alone. The flexible policy was the most effective.

Cost results
The cost per smoker with full PT costs were $34.46 with a policy covering Rx-PT only, $62.51 with all PTs, $6.62 with BT alone, $64.95 with BT and Rx-PT, $94.69 with a flexible policy, and $10.16 with brief intervention alone.

Synthesis of costs and benefits
Incremental cost-effectiveness ratios (i.e. the cost per quit) were calculated to combine the costs and benefits of the alternative policies in comparison with no intervention.

The incremental cost per quit was $7,185.15 with Rx-PT only, $8,251.06 with all PTs, $2,500.94 with BT alone, $8,120.78 with BT and Rx-PT, $7,394.19 with a flexible policy, and $3,381.03 with brief intervention alone.

Variations in PT costs did not change the base-case cost-effectiveness results substantially.

Authors’ conclusions
Tobacco treatment policies (TTPs; access policies and brief intervention) increased quit rates at a reasonable cost from the perspective of the service payer. Flexible coverage (i.e. the coverage of all treatment options) was the most effective, while the coverage of behavioural therapy (BT) alone was the most cost-effective.

CRD COMMENTARY - Selection of comparators
The authors justified the choice of the comparators and all alternative treatment strategies were considered in the analysis. The authors stressed that the choice of treatment categories was based on the need for simplicity, differences in effectiveness, and policy relevance. You should decide whether they are valid comparators in your own setting.

Validity of estimate of measure of effectiveness
The effectiveness data came from published evidence. However, it was not stated whether a systematic review of the literature was undertaken to identify the primary studies. The primary studies were not described, thus it was not possible to assess the validity of the primary sources. A narrative method appears to have been used to combine the primary estimates. Some assumptions, some of which were investigated in the sensitivity analysis, were made to adapt data obtained from the literature.

Validity of estimate of measure of benefit
The summary benefit measure was specific to the interventions considered in the study and it is not comparable with the benefits of other health care programmes. This measure was obtained using a model framework. Details of the methods used to estimate the quit rate were given.

Validity of estimate of costs
The authors stated explicitly which perspective was adopted in the study. However, it was noted that doctor and time costs were included in the analysis, although the role played by these items was unclear. Details on the unit costs and the quantities of resources used were not given, which limits the possibility of replicating the analysis. The costs were treated deterministically and were specific to the study setting. In fact, alternative cost estimates were not tested in the sensitivity analysis. The costs were mainly derived from published studies. The price year was reported, which aids reflation exercises in other settings.
Other issues
The authors did not make extensive comparisons of their findings with those from other studies. The issue of the generalisability of the study results to other settings was implicitly addressed in the sensitivity analysis, where alternative values for model inputs were considered. The study referred to smokers and this was reflected in the authors’ conclusions.

Implications of the study
The study results supported the use of tobacco policies. However, the authors stated that further research is needed to examine how TTPs affect treatment effectiveness and use of covered and non covered treatments. The use of a longer time horizon would be helpful.

Source of funding
Partially funded by the Substance Abuse and Mental Health Services Administration, US Department of Health and Human Services, and the Robert Wood Johnson Foundation (grant number 037856).

Bibliographic details

PubMedID
11833665

Other publications of related interest


Indexing Status
Subject indexing assigned by NLM

MeSH
Computer Simulation; Cost-Benefit Analysis; Decision Theory; Health Behavior; Health Care Costs; Humans; Public Policy; Smoking /epidemiology /therapy; Tobacco Use Cessation /economics /psychology; United States /epidemiology

AccessionNumber
22002008071

Date bibliographic record published
31/10/2005

Date abstract record published
31/10/2005