A cost-effectiveness analysis of genetic testing of the DRD2 Taq1A polymorphism to aid treatment choice 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.

CRD summary
This study evaluated the cost-effectiveness of a hypothetical test of a single gene polymorphism in addition to current smoking cessation strategies. The authors concluded that testing was unlikely to be cost-effective, from a National Health Service perspective, and administering nicotine replacement therapy and bupropion to all was the most cost-effective strategy. Given the limited reporting of the methods for deriving the measure of benefit and the costs, it is not possible to assess whether the authors' conclusion is appropriate.

Type of economic evaluation
Cost-utility analysis

Study objective
The aim was to evaluate the cost-effectiveness of smoking cessation therapies, with a hypothetical test for a single gene polymorphism (dopamine receptor D2, DRD2, gene), which predicts treatment response. The therapies, for smokers with European ancestry seeking help to quit, were nicotine replacement therapy (NRT), bupropion, their combination, or standard care. There were two control groups, one of which received brief advice, and the other individual counselling.

Interventions
The DRD2 gene Taq1A polymorphism had been shown to identify populations with different response rates to NRT and bupropion. Ten different strategies were considered for each control group. Four strategies did not involve DRD2 testing and all the genotypes were treated similarly. In the remaining six strategies, the DRD2 test was used to allocate treatment according to the patient's genotype; CC (A2A2) was compared with CT (A2A1) and TT (A1A1).

Location/setting
UK/primary care.

Methods
Analytical approach:
A model that combined the 12 month cessation rates, relapse rates, lifetime QALYs gained by lifetime cessation, and costs was developed and analysed using Bayesian synthesis methods in WinBUGs. The time horizon was lifetime and the authors reported that a National Health Service (NHS) perspective was used.

Effectiveness data:
The effectiveness parameters came from a non-systematic literature review, and relied heavily on a previous economic model (Woolacott, et al. 2002, see 'Other Publications of Related Interest' below for bibliographic details), which included a systematic review of clinical effectiveness and three studies that investigated the effect of genotype on cessation rates. The main effectiveness estimates included the 12 month cessation rates of the different strategies, as well as their modifications according to different genetic sub-populations, and relapse rates.

Monetary benefit and utility valuations:
Quality-adjusted life-years (QALYs) gained from lifetime smoking cessation were extracted from Woolacott, et al. 2002.
Measure of benefit:
The incremental net benefits were estimated, for different willingness-to-pay per QALY thresholds, and were not discounted.

Cost data:
The cost categories included those of the different treatment strategies, as well as the genetic testing. The costs of treatment were taken from Woolacott, et al. 2002, but the sources for the costs of the genetic testing were not cited. The currency was UK pounds sterling (£) and the price year was 2001. All costs were short term, so discounting was not necessary.

Analysis of uncertainty:
Probabilistic sensitivity analysis was undertaken to take account of multi-parameter uncertainty. The authors stated that the cost of treatment was not influential and so the average costs were used and they were not analysed for uncertainty. The test costs were varied in a scenario analysis.

Results
The costs and benefits were not reported separately, and only incremental net benefits were reported for each strategy.

Regardless of the control scenario and the cost of the test, administering NRT and bupropion to all was the strategy with the highest probability of being cost-effective. This was followed by the strategy of testing and offering bupropion if the genotype was CC and offering NRT if the genotype was CT or TT.

Cost-effectiveness acceptability curves were presented and, at a willingness to pay of £ 30,000, with individual counselling as the control, administering NRT and bupropion to all had a 76% chance of being most cost-effective.

Some incremental cost-effectiveness ratios were reported. The incremental net benefit was greater with individual counselling as the control, decreased with the cost of the test, and increased with a decreasing relapse rate, but the results were robust to the parameter uncertainty.

Authors' conclusions
The authors concluded that testing for genotypes of the DRD2 gene was unlikely to be cost-effective, from a NHS perspective, and giving NRT and bupropion to all patients was the most cost-effective strategy. The cost-effectiveness of genetic tailoring of therapy was not guaranteed and single gene tests were unlikely to be cost-effective due to their low predictive value.

CRD commentary
Interventions:
The level of reporting of the interventions was adequate, and the main aim was to evaluate the potential cost-effectiveness of a hypothetical genetic test. The authors evaluated a broad range of interventions as well as two control comparators, which seems adequate for the research question.

Effectiveness/benefits:
The authors used published studies, including genotype ones, for their clinical data. They relied heavily on what appears to have been a thorough systematic review (Woolacott, et al. 2002), but other studies may have been published since this review. The authors evaluated the consistency in the estimates between the genotype studies and the Woolacott review, but they did not compare the characteristics of these studies. The derivation of the QALYs was not described in detail, and it was not clear whether or not the lifetime benefits of quitting were discounted.

Costs:
The cost details were not well reported. The authors only discussed the treatment costs and did not mention any related disease episodes. The inclusion of these disease episodes could significantly affect the cost-effectiveness of the strategies.

Analysis and results:
Incremental cost-effectiveness ratios were reported, but their meaning was not clear. Although probabilistic results are more useful in terms of assessing the global uncertainty, mean cost-effectiveness ratios are still helpful and widely used.

Concluding remarks:
Given the limited reporting of the methods for deriving the measure of benefit and the costs, it is not possible to assess whether or not the authors’ conclusion is appropriate.

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