The cost-effectiveness of interleukin-1 genetic testing for periodontal disease
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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 use of genetic testing to establish whether a patient is susceptible to periodontal disease on the basis of their interleukin-1 genotype.

Type of intervention
Screening.

Economic study type
Cost-utility analysis.

Study population
A hypothetical study population consisting of Caucasian men and women aged 35 years was included in the model. These individuals had been referred to a periodontist after being diagnosed with mild periodontitis.

Setting
The setting was secondary care. The economic study used cost data from Washington, USA.

Dates to which data relate
The effectiveness data were estimated from trials published between 1985 and 2000. The price year was not clearly stated, but it may have been 1998.

Source of effectiveness data
The effectiveness data were derived from a review and synthesis of completed studies.

Modelling
A decision tree and a Markov model were used. The decision tree, which determined the proportions of patients in each cohort that went into the Markov model, compared the outcomes of tested and not tested patients. The Markov model, which was used to simulate the disease progression, measured the costs and quality-adjusted life-years (QALYs) that occurred over 30 years for a cohort of 1,000 patients.

Outcomes assessed in the review
The main model parameters estimated from the review were smoking prevalence and quit rates, and past and future compliance with overall and acute treatment regimens.

Study designs and other criteria for inclusion in the review
To be included in the review, the studies had to have a sample size of more than 30, have been carried out after 1980, and have a study population aged between 35 and 65 years. Smoking cessation compliance rates and effectiveness estimates were derived from randomised controlled trials.

**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**
Approximately 17 studies were included in the review.

**Methods of combining primary studies**
Not stated.

**Investigation of differences between primary studies**
Not stated.

**Results of the review**
The base-case values are reported here along with the range used in the sensitivity analysis (in brackets).

The smoking quit rate was 11.35% (6.7 - 16) with therapy and 5.75% (2.5 - 9) without therapy.

The past compliance prevalence was 25% (10 - 35) and the future compliance prevalence was 50% (40 - 60).

The long-term drop out rate with maintenance therapy was 9.4% (4.9 - 13.9).

**Methods used to derive estimates of effectiveness**
The estimates of positive and negative predictive values were derived from the authors' assumptions.

**Estimates of effectiveness and key assumptions**
The positive predictive value of the test was 97% (94 - 100) and the negative predictive value was 97% (94 - 100).

**Measure of benefits used in the economic analysis**
The measure of benefit was the QALY. The range of utility measures for mild and severe periodontitis was estimated from a literature review and from clinical opinion. The numbers of severe cases of periodontitis were also given. The QALYs were discounted at a rate of 3%.

**Direct costs**
The costs were discounted at a rate of 3%. This was necessary since the study took place over a 30-year time period.
Some of the unit costs were reported, whereas the resource quantities (which were largely a result of the model) were not. The perspective was that of a health care payer (Washington Dental Service). The direct medical cost data were recorded for several health states. These were mild or moderate periodontitis treatment, mild or moderate periodontitis maintenance care, severe periodontitis treatment and severe periodontitis maintenance care. The costs were for a comprehensive oral exam, periodontal scaling and root planning, perio maintenance care, osseous surgery per quadram and implants.

These data were obtained from the Washington Dental Service and were based on the reimbursement rates for periodontal services. The costs were from 1998. The direct costs also included the cost of the genetic test (from the manufacturer) and the laboratory fee. The Markov model estimated the final costs.

**Statistical analysis of costs**
The costs were treated deterministically.

**Indirect Costs**
No indirect costs were reported.

**Currency**
US dollars ($).

**Sensitivity analysis**
A one-way sensitivity analysis was carried out on each parameter. The worst- and best-case scenarios were also analysed. The impact these had on the incremental costs, incremental QALYs, incremental cases of severe periodontitis and the incremental cost-effectiveness ratio (ICER), were examined.

**Estimated benefits used in the economic analysis**
The QALYs increased by 4.5 (from 18,745.8 to 18,750.3) for the whole cohort.

**Cost results**
Using a genetic test produced additional costs of $147,114 per 1,000 patients over the 30 years. These costs were discounted at a rate of 3%.

**Synthesis of costs and benefits**
In the base case, an ICER of $32,633 was obtained for testing compared with no testing.

For the worst-case set of parameters that favoured no testing, no testing dominated testing. In other words, the costs were less and the benefits higher for no testing. For the best-case set of parameters that favoured testing, testing dominated no testing.

The one-way sensitivity analyses showed that there were three variables that exhibited a significant impact on the results. These were patient compliance, the effectiveness of non-surgical therapy and the cost of the test.

When the treatment compliance was increased from 10 to 35%, the ICER increased from $12,651 to $231,365 per QALY.

When the effectiveness of the treatment risk ratio was varied from 0.7 to 0.3, the ICER varied from $61,510 to $18,786 per QALY.

When the cost of the test was varied from $100 to $300, the ICER varied from $10,451 to $54,816 per QALY.
Authors' conclusions
When performing the test on patients with mild disease, there may be an increase in direct medical costs and a decrease in severe cases of the disease. Patient morbidity also decreased. The authors also concluded that, if the treatment effectiveness is independent of interleukin-1 genotype, then testing could be cost-effective.

CRD COMMENTARY - Selection of comparators
The comparator was no test, which was appropriate for the study question. This would mean that individuals who were not tested did not know their genotype.

Validity of estimate of measure of effectiveness
The authors did not state that a systematic review of the literature had been undertaken. They used data from the available studies selectively, and did not consider the impact of differences between the primary studies when estimating the effectiveness. However, some inclusion criteria and the types of study designs that contributed to the estimates were mentioned. There was no supporting evidence for the estimates of effectiveness, but a sensitivity analysis was carried out. The authors acknowledged their incomplete knowledge of the biology of periodontal disease, the genetic susceptibility of different ethnic groups to periodontal disease, and the optimal treatment of the disease.

Validity of estimate of measure of benefit
The authors used QALYs as a measure of health benefit. It was not stated that a systematic review of the literature had been undertaken to identify the utilities. The data from the studies were used selectively, and the impact of differences between the primary studies was not considered when estimating the utilities.

Validity of estimate of costs
Given the third-party payer perspective, most of the costs seem to have been included. Some unit costs were reported, whereas the resource quantities (which were largely a result of the model) were not. The price year should have been clearly reported instead of being left to inference. The unit costs, quantities and the price year would need to be reported in full if the results are to be reproduced in a different setting. A sensitivity analysis of the direct costs only was undertaken. A sensitivity analysis of the quantities was not conducted, nor was a statistical analysis of the prices.

Other issues
The authors did not make appropriate comparisons of their findings with those from other studies. The study was carried out over a 30-year period, which might be too long from the perspective of a third-party payer if patients are likely to change jobs. The authors stated that the study focused only on Caucasians. This may bias the results on account of differences in disease prevalence among other populations. It also limits the populations to which the results would be generalisable.

Implications of the study
The use of economic information obtained from genotype testing, in the management of patients, needs to be considered. Genotype testing could be used to test for other diseases. Ethical issues concerned with genetic testing may also arise. For example, payers may be unwilling to cover someone who has a severe disease.

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