An economic analysis of continuous positive airway pressure for the treatment of obstructive
sleep apnea-hypopnea syndrome

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 examined the cost-effectiveness of continuous positive airway pressure (CPAP) for the treatment of obstructive sleep apnoea-hypopnoea syndrome. It was commissioned by the National Health Service (NHS) Health Technology Assessment Programme to support the National Institute of Health and Clinical Excellence’s appraisal of CPAP. The authors concluded that CPAP was a cost-effective alternative to dental devices and lifestyle advice, from the perspective of the NHS. The study was based on valid methodology, which makes the authors’ conclusions more robust.

Type of economic evaluation
Cost-utility analysis

Study objective
This study examined the cost-effectiveness of continuous positive airway pressure (CPAP) during sleeping for the medical treatment of moderate or severe symptomatic obstructive sleep apnoea-hypopnoea syndrome.

This study was commissioned by the UK National Health Service (NHS) Health Technology Assessment (HTA) Programme to support the National Institute of Health and Clinical Excellence (NICE)’s appraisal of CPAP.

Interventions
The CPAP medical treatment strategy was compared with both dental devices and lifestyle advice.

Location/setting
UK/secondary care.

Methods
Analytical approach:
A Markov model was developed to determine the costs and benefits of the three strategies over the patient’s expected lifetime. The authors stated that the analysis was conducted from the perspective of the UK NHS and Personal Social Services (PSS).

Effectiveness data:
The clinical data came from a systematic review of the literature, which was supplemented with evidence from known, relevant studies, including randomised controlled trials (RCTs), administrative databases, and other non-randomised studies. The key details on data extraction and combination were reported. Data on the treatment effect, which was the key clinical endpoint, were taken from the RCTs and were combined using a meta-analytic approach. The link between the treatment effect and reduction in blood pressure, and consequently future cardiovascular events, was estimated using Framingham risk equations. Compliance with treatment was taken from long-term observational studies. Some assumptions were made to overcome the lack of data for some inputs to the model and these were explicitly stated.

Monetary benefit and utility valuations:
The utility values were derived from studies that used the Short Form (SF-6D) and the European Quality of life (EQ-5D) instruments. Changes in the Epworth Sleepiness Scale, which was the main clinical outcome in the RCTs,
were converted into changes in SF-6D and EQ-5D scores. These data were then converted into health-related quality-of-life (HRQoL) weights, using the preferences of the UK population. The health utilities associated with cardiovascular events and road traffic accidents (RTAs) were obtained from published studies and based on a regression analysis.

Measure of benefit:
Quality-adjusted life-years (QALYs) were the primary summary benefit measure, which incorporated the impact of the treatment on sleepiness, blood pressure, RTAs, and HRQoL. The discount rate was 3.5%.

Cost data:
The economic analysis considered the costs of the interventions and the health care resources associated with stroke, coronary heart disease (CHD), and RTAs. The costs and resource use for the CPAP device were derived from a technical submission to NICE. The cost of the dental device was based on clinical opinion. The cost of lifestyle advice reflected that of a visit to a general practitioner. The costs of stroke and CHD were derived from published estimates, and the costs of RTAs were obtained from the Department of Transport. All costs were expressed in UK pounds sterling (£) at 2005 to 2006 prices. The discount rate was 3.5%.

Analysis of uncertainty:
An extensive probabilistic sensitivity analysis was undertaken on the model inputs, which were assigned stochastic distributions. The expected value of perfect information (EVPI) was calculated, which puts a value on the elimination of all uncertainty through additional research. Finally, sub-group analyses were undertaken on gender, syndrome severity, and other baseline patient characteristics.

Results
For a hypothetical 50-year-old man, the total costs were £8,140 with lifestyle advice, £8,797 with dental devices, and £9,301 with CPAP. The increased costs of CPAP were due to higher treatment costs, while the non-treatment costs were lower than those for the other strategies.

The QALYs were 11.93 with lifestyle advice, 12.26 with dental devices, and 12.39 with CPAP. The incremental cost per QALY gained with CPAP over dental devices was £3,899.

The probability of CPAP being more cost-effective than its comparators, at a cost-effectiveness threshold of £20,000 per QALY, was 0.78 for men and 0.80 for women. The cost-effectiveness of CPAP improved in patients with more severe symptoms.

The base-case EVPI per episode was estimated at £183 (men) and £202 (women) for a cost-effectiveness threshold of £20,000 per QALY. The male population EVPI was £33million.

Authors' conclusions
The authors concluded that CPAP was a cost-effective alternative to dental devices and lifestyle advice from the perspective of the NHS, especially in patients with more severe disease.

CRD commentary
Interventions:
The rationale for the selection of the comparators was clear. The authors stated that other options for the treatment of obstructive sleep apnoea-hypopnoea syndrome existed, such as surgery or drugs, but the available evidence did not support their use. The analysis focused appropriately on CPAP, dental devices, and lifestyle advice, as these were routinely available in the UK NHS.

Effectiveness/benefits:
The clinical data were derived using a validated approach to identify all the possible sources of evidence. More details of the systematic review were provided in the HTA technical report, which was published separately. The rigorous methodology ensured the validity of the clinical estimates. The treatment effect was obtained from RCTs, which were appropriately pooled through a meta-analysis. Other estimates were based on valid evidence. The key steps in the derivation of the utility valuations for the QALYs were extensively described. QALYs are a valid benefit measure and
they allow cross-disease comparisons to be made.

Costs:
The economic analysis was consistent with the perspective. The costs were only presented as macro-categories, but the unit costs and resource quantities, as well as other details of the economic analysis, were extensively described in the technical report. The sources of all data were given and the assumptions required were explicitly reported, which makes the whole economic analysis more transparent. The price year was reported, which allows reflation exercises for other time periods. The use of discounting was reported and was based on NICE guidance.

Analysis and results:
The costs and benefits were appropriately synthesised by means of an incremental approach. The findings were clearly presented for both the primary and the secondary analyses. The issue of uncertainty was satisfactorily addressed and the key features of the sensitivity analyses were described. The authors noted some potential limitations of their study such as the use of assumptions due to a lack of evidence for some key aspects of the model, which were relatively rare events. They also pointed out that most of the published evidence referred to middle-aged patients, and that caution might be needed if applying these findings to a population of elderly patients with other diseases. They also stated that the variety of dental devices reported in the literature limited the reliability of their findings, because it was unclear which type of device might be more effective compared with CPAP.

Concluding remarks:
The study was based on valid methodology, which makes the authors’ conclusions more robust.

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