Cost-effectiveness of using continuous positive airway pressure in the treatment of severe obstructive sleep apnoea/hypopnoea syndrome in the UK

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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
The objective was to assess the cost-effectiveness of using continuous positive airway pressure (CPAP) in comparison with no treatment, for the management of patients with severe obstructive sleep apnoea/hypopnoea syndrome. The authors concluded that CPAP was a highly cost-effective alternative to no treatment, from the perspective of the UK National Health Service. The study was based on clearly reported and valid methodology, which makes the authors’ conclusions more robust.

Type of economic evaluation
Cost-utility analysis

Study objective
The objective was to assess the cost-effectiveness of using continuous positive airway pressure (CPAP) for the management of patients with severe obstructive sleep apnoea/hypopnoea syndrome (OSAHS), defined by an apnoea-hypopnoea index (AHI) of over 30 and daytime sleepiness.

Interventions
The two strategies were CPAP compared with no treatment.

Location/setting
UK/medical centre.

Methods
Analytical approach:
This economic evaluation was based on a Markov model with a 14-year time horizon. The authors stated that the analysis took the perspective of the National Health Service (NHS).

Effectiveness data:
The clinical data came from a comprehensive literature review. Key terms for the search were reported, but the sources searched and specific inclusion criteria for the study selection were not reported. Average estimates were calculated to combine the inputs derived from more than one study. The reduction in risk of cardiovascular events was taken from a long-term observational study, while the risk of road traffic accidents was taken from a case-control study. Other studies were also used to calculate patient compliance with treatment. The key clinical endpoint was the reduction in cardiovascular events due to treatment.

Monetary benefit and utility valuations:
The utility valuations were derived from a Spanish study, which included patients with OSAHS, who completed the European Quality of life (EQ-5D) questionnaire.

Measure of benefit:
Quality-adjusted life-years (QALYs) were used as the summary benefit measure and were discounted at an annual rate of 3.5%. Other model outputs such as the probability of survival, number of cardiovascular events, and road traffic accidents (RTA) were also reported, but were not combined with costs.
Cost data:
The economic analysis included the CPAP device, humidifier and mask, out-patient visits, personnel time, home sleep study, home or hospital titration study, hospital stay, and home-based cardiac rehabilitation. The resource use was not found in any publication, and was therefore taken from interviews with 19 randomly selected clinicians, from across the UK, who managed large established sleep services. The costs came from multiple sources including the Departments of Health and Transport, and a published study. They were in UK pounds sterling (£) and referred to 2005 to 2006 prices. Those accrued after the first year were discounted at an annual rate of 3.5%.

Analysis of uncertainty:
The issue of uncertainty was analysed using both a deterministic sensitivity analysis, which considered individual model inputs, and a probabilistic analysis, which assigned pre-defined probability distributions to all the inputs.

Results
Over the 14-year time horizon, the expected QALYs were 7.22 (95% confidence interval, CI: 6.48 to 7.93) with no treatment and 8.09 (95% CI: 7.17 to 8.44) with CPAP. A total of 57% of untreated patients were expected to be alive after 14 years compared with 72% of patients treated with CPAP, while 30% of untreated patients were expected to have survived event-free after 14 years compared with 58% of those treated with CPAP.

The NHS costs were £10,645.02 with no treatment and £9,672.25 with CPAP. The greatest cost component was associated with the management of stroke for both strategies.

In the base case, CPAP was the dominant strategy, as it was simultaneously less expensive and more effective than no treatment. Treatment with CPAP for one year was not cost-effective because the cost per QALY was greater than £20,000. However, after two years of treatment, the cost per QALY was below £10,000 and, after 13 years of treatment, CPAP was dominant.

The probabilistic sensitivity analysis suggested that, at a threshold of £20,000 per QALY, CPAP had a 99% probability of being cost-effective. The deterministic analysis indicated that even after the removal of cardiovascular and cerebrovascular events and RTAs, CPAP remained a cost-effective strategy. The analysis also identified the most influential model inputs, which were the proportion of patients who continued using CPAP, the risk of having a cardiovascular or cerebrovascular event, the risk of having an RTA, the utility for treated and untreated OSAHS, the cost of managing a non-fatal RTA, and the cost of managing stroke rehabilitation. However, plausible variations in these inputs did not substantially alter the findings.

Authors' conclusions
The authors concluded that CPAP was a highly cost-effective alternative to no treatment for patients with OSAHS from the perspective of the UK NHS.

CRD commentary
Interventions:
The authors stated that CPAP was the treatment of choice for patients with OSAHS, established through meta-analyses, while the alternative for patients who could not tolerate CPAP was no treatment and so the selection of the interventions was appropriate.

Effectiveness/benefits:
The use of a literature review was a valid approach for identifying the relevant sources of data to populate the decision model. The methods and conduct of the review were not extensively described, but the authors provided a clear description for each source of data, which was often a non-randomised study. The selection of an observational study as the main data source was justified on the grounds of its long follow-up, which was consistent with the time horizon of the model. The uncertainties underlying most estimates were investigated in the sensitivity analysis. Key information on the derivation of the utility valuations used to calculate the QALYs was provided. The authors pointed out that the utility data from a Spanish population might not be applicable to the UK setting, but no other published data were available. QALYs are a validated benefit measure, appropriate for this patient population, and can be compared with the benefits of other health care interventions.
Costs:
The analysis of costs appears to have been consistent with the economic viewpoint. The key cost items were reported as well as the price year, the sources of costs and resource consumption, and the use of discounting. The probability estimates on resource consumption were explicitly presented, but no details on the actual resource use were provided. The probability distributions used in the sensitivity analysis were appropriate. In general, the economic analysis appears to have been carried out in a credible fashion. The authors stated that some categories of costs not relevant to the NHS payer were excluded, but their inclusion would have favoured the CPAP arm of the model.

Analysis and results:
The use of an incremental analysis to synthesise and compare the costs and benefits of the two strategies was appropriate and showed the superior profile of CPAP. The issue of uncertainty was appropriately addressed in the sensitivity analyses, the methods of which were explicitly described. Both the deterministic and probabilistic approaches were valid for investigating different aspects of the overall uncertainty. The findings were clearly presented, especially with respect to secondary outputs of the model. The authors noted some potential limitations of their model, which have already been described.

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

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