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Journal search and commentary

Is nasal continuous positive airway pressure treatment cost effective? Using a standard economic evaluation checklist as a basis for assessment of a cost effectiveness evaluation of nasal continuous positive airway pressure (nCPAP) treatment

Jeff Kirsch

Global Health Outcomes, GlaxoSmithKline, Greenford, Middlesex, UK

1. Article Reviewed

Title: The cost effectiveness of nCPAP treatment in patients with moderate-to-severe obstructive sleep apnoea syndrome (OSAS).

Author(s): Mar J, Rueda JR, Durán-Cantolla J, Schechter C, Chilcott C.

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2. Objective

Determine cost-effectiveness for nCPAP treatment for moderate to severe sleep apnoea patients using accepted standard models for this evaluation.

3. Methods

The economic evaluation performed by Mar et al. in this article is based on a modelling approach, often used to predict the long term costs and outcomes of treatments when it would be otherwise impractical to conduct extended, empirical, controlled outcomes studies. The semi-Markov model, constructed for the analysis, provides a framework that predicts costs and outcomes for alternative treatment options over both a 5-year and lifetime treatment-time horizon. Its flexible construction enables the authors to test the assumptions made and the data used in the evaluation on the robustness of the study results.

4. Results

The main finding of this study is that the cost effectiveness of nCPAP is comparable to or less than that for commonly funded treatments for other chronic disorders and that this results primarily from the quality of life benefits that nCPAP treatment produces.

5. Commentary

Increasing demand for scarce healthcare resources calls for decisions to be made regarding the implementation of competing health care technologies. Economic evaluations can inform such decisions but reviewers and those who make use of this information often lack the experience to critically assess them. Several guidelines and checklists exist to help make these assessments [1–5]. The article reviewed here asserts that nasal continuous positive airway pressure (nCPAP) is cost effective for the treatment of moderate to severe obstructive sleep apnoea syndrome (OSAS). The following demonstrates how these guidelines for economic evaluation may be applied to evaluate this article. This serves to present the salient points of the study in this article and also provides the reader with a method that can be used to assess other economic evaluations in sleep medicine. The checklist used in this instance was developed by Drummond et al. [4].

The following assessment indicates the way in which the model and analysis addresses some of the key requirements for economic evaluations.

E-mail address: jeff.kirsch-1@gsk.com (J. Kirsch).

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6. Q1—Was a well defined question posed in an answerable form?

Mar et al. in their article recognize the need for this evaluation, citing that economic evaluations applied to OSAS to date have mainly concentrated on establishing the cost effectiveness of diagnostic procedures rather than on treatment approaches. The study subsequently sets out to determine the cost effectiveness of nCPAP based on comparing nCPAP treatment to the conventional alternative of letting the natural progression of OSAS continue without treatment. Other alternative treatments, while available, are either rarely used or generally ineffective for moderate to severe apnoea; thus, the comparison with no treatment other than natural course of the disorder is justified for this analysis of cost effectiveness. The cost effectiveness for nCPAP, once determined, is then in this article, further evaluated from the payers' perspective (specifically for the Basque Country region of Spain) by comparison with the cost effectiveness of healthcare technologies for other disorders that compete for health authority funding. Whilst it is a logical choice to put nCPAP into this perspective of economic competition, the study ignores wider potential societal benefits from decreased sleepiness, such as improved economic productivity and increased work place and home safety, and may therefore underestimate the cost effectiveness of nCPAP in the broader societal context.

7. Q2—Was a comprehensive description of the competing alternatives given?

Specific details regarding the actual diagnosis and treatment strategy under analysis (i.e. the option of diagnosing OSAS and treating it with nCPAP) are described in the base case definition and costing section. It is not clear how generalizable the diagnosis process is, but the authors address this issue in the sensitivity analysis (see Q9). The actual implementation of nCPAP at the patient level is assumed to be widely known and accepted. The 'do nothing' (or no OSAS treatment) alternative assumes that usual care to treat other cardiovascular risk factors may be employed. However, it is also assumed that this occurs in the nCPAP group as well, and the impact of this treatment of cardiovascular risk factors is 'cancelled out' within the model.

8. Q3—Was the effectiveness of the programs or services established?

Effectiveness outcomes are established in several ways in this study; firstly, in terms of the reduction in potential physical mortality and morbidity with respect to cardiovascular events (fatal or non-fatal coronary heart disease (CHD) and fatal or non-fatal stroke) and car accidents (fatal and non-fatal). Secondly, the impact of treatment on patient quality of life (QOL) is established using a method that applies a measure of value (or utility) associated with different states of health (in this instance treated or untreated OSAS). Literature values are used to derive the morbidity and mortality outcomes while an empirical study, conducted by the authors, is used to determine the OSAS health state values (utilities).

9. Q4—Were all important and relevant costs and consequences for each alternative identified?

As outlined by the authors the costs of OSAS diagnosis and nCPAP include the unit cost of the nCPAP device and supplies, in-home annual maintenance costs and annual medical follow up. While the costs of cardiovascular events are included, those for car accidents do not appear to be specifically stated. The authors also indicate that the potential reduction in consumption of healthcare resources due to the implementation of nCPAP is not included in the model, as no direct measure of this outcome has been established. This may lead to an underestimation of the relative cost effectiveness of nCPAP. An assumption is made about the capital write-off period for the nCPAP equipment over a 5-year period. Whilst it appears that the authors might expect the equipment to be replaced at this point, continuing to use the same equipment after the write-off period could potentially improve the cost effectiveness of nCPAP (as there would be a 'zero' equipment cost after year 5).

All important consequences of OSAS and its treatment appear to be identified, although the model does not appear to take nCPAP treatment compliance (or non-compliance) into account. This may lead to overestimation of cost effectiveness if non-compliance leads to poorer health outcomes.

10. Q5—Were costs and consequences measured accurately in appropriate physical units?

The costs of implementing the diagnosis process and the nCPAP are based on a diagnostic protocol and assumptions are made regarding the frequency of device maintenance and medical follow-up, respectively. The costs of CV events come from a non-referenced source (all public hospitals in the Basque Country) and are not presented as physical resource units.

Effectiveness outcomes are either based on published values (i.e. the probability of morbid or mortality outcomes) or empirical study (i.e. utility values for patients before and after nCPAP). The former appear to come from a limited set of references, so it is not clear how much the numbers used are representative or generalizable to the larger populations. The utility values come from a non-controlled study that has

inherent problems of potential bias. Nevertheless, the appropriateness of using of these effectiveness measures is explored via sensitivity analyses.

11. Q6—Were costs and consequences valued credibly?

Costs were applied using data from the year 2000, although the source of the prices used is not exactly clear. The reference cost of the specified nCPAP device is based on an Australian version, curiously using a 2001 price. Cardiovascular event costs are based on 1998 prices adjusted to 2000 prices.

Values for morbidity and mortality effectiveness outcomes are based on literature values and have already been discussed. The utility values before and after 3 months nCPAP treatment are derived by administering a utility generating questionnaire to patients (the EQ 5D). It is assumed that the improvement in utility seen with nCPAP is maintained over the period of the analysis (either 5 years or the lifetime of the patient). The impact of this specific assumption is not directly tested and could result in the misspecification of the cost effectiveness of nCPAP. The impact of testing a range of utility outcomes is, however, assessed as part of the sensitivity analysis.

Patients not treated with nCPAP apparently are assumed to remain at the pre-treatment level if no other morbid events occur during the period of analysis. This may or may not be a valid assumption.

12. Q7—Were costs and consequences adjusted for differential timing?

The authors apply a discount rate of 3% to both costs and outcomes as recommended by the US panel on Cost Effectiveness [6] in order to allow for the economic notion of 'time preference' [4]. Alternative discount rates are also applied as part of the sensitivity analysis to test this variable on the study result. Differential rates for costs and outcomes are also applied to address the potential issue that health benefits should be discounted at a lower rate than costs.

13. Q8—Was an incremental analysis of costs and consequences of alternatives performed?

All the cost effectiveness ratios in this study are presented as the incremental costs and outcomes of using nCPAP treatment versus usual care without any treatment for sleep apnoea. The incremental cost effectiveness ratio (ICER) is presented as the cost (i.e. Euros) per Quality Adjusted Life Year (QALY) gained. The QALY takes into account both changes in mortality and morbidity due to treatment with nCPAP in a single measure.

14. Q9—Was allowance made for uncertainty in the estimates of costs and consequences?

An extensive number of sensitivity analyses were employed to test alternative treatment and outcome assumptions. These included the patient population age and gender, the relative risk of stroke (untreated), the treatment utility gain, the benefits of nCPAP on blood pressure, treatment drop out rates, the cost of nCPAP and the discount rates for costs and outcomes.

The results of these sensitivity analyses indicate that the results remain relatively stable over a range of plausible scenarios. The base case analysis indicates that the incremental cost effectiveness of nCPAP is €7861 per QALY gained over a 5-year time horizon, reducing to €4938 per QALY gained over the lifetime of the patient. The results range from €5000 to €10,000 per QALY, gained under the majority of sensitivity analysis assumptions, with the exception of the worst case (i.e. lowest) 5-year time horizon scenario for the utility gain where the cost per QALY gain was €42,235.

15. Q10—Did the presentation and discussion of the study results include all issues of concern?

Generally, the authors presented a number of important issues that might be of concern to the reader. The results of the study are restricted to patients with moderate to severe OSAS and the cost effectiveness of nCPAP treatment for these patients is put into perspective against the cost effectiveness of other widely used interventions such as anti-hypertensive medications.

The authors also highlight the fact that, whilst much attention has been paid in the literature to different diagnostic procedures, the diagnostic procedure itself has little impact on overall treatment cost effectiveness. The relatively low impact of potential treatment cost variation and time horizon (5 year versus lifetime) on the overall incremental cost effectiveness of nCPAP is also highlighted.

Finally, and perhaps most importantly, the issue of quality of life improvement is discussed. As the main driver of the cost effectiveness results, the validity of the utility (health state) values derived from the authors' empirical study is assessed against other, less conservative literature values. The authors acknowledge that a controlled comparison of change in utility value due to nCPAP treatment would be preferable, but that this remains ethically and technically difficult to implement. No mention, however, is made of the appropriateness of extending the 3-month improvement in quality of life over the 5 year or lifetime time horizon in the model.

16. Conclusion

In conclusion, it can be seen that the checklist approach is a useful tool for summarizing and assessing economic evaluations. In this instance the study by Mar et al. of nCPAP appears to address most of the key issues required to make a formal cost-effectiveness evaluation. As with many such evaluations, there are several outstanding questions and items, highlighted in the above assessment, which would benefit from further expansion or investigation by the authors. Nonetheless this analysis supports the concept that the cost effectiveness of this treatment is in line with that of widely used interventions for other disorders. It deserves special note that the primary cost effectiveness benefit comes from the increased quality of life due to nCPAP and not directly from reduced CV and car accident morbidity and mortality.

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