Cost-effectiveness of long-term oxygen therapy for chronic obstructive pulmonary 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.

CRD summary
This study evaluated the cost-effectiveness of long-term oxygen therapy for patients with chronic obstructive pulmonary disease, compared with no oxygen therapy. The author concluded that continuous oxygen therapy was cost-effective, while nocturnal oxygen therapy was not. There were a number of limitations to the study and these should be carefully considered when interpreting the author’s conclusions.

Type of economic evaluation
Cost-utility analysis

Study objective
The aim was to evaluate the cost-effectiveness of long-term oxygen therapy in patients with chronic obstructive pulmonary disease (COPD), compared with no oxygen therapy.

Interventions
Both continuous and nocturnal long-term oxygen therapy were evaluated. Continuous therapy was evaluated for a cohort of patients with severe resting hypoxaemia, while nocturnal therapy was evaluated for a cohort of patients with nocturnal desaturation.

Location/setting
USA/community.

Methods
Analytical approach:
A three-state Markov model was used to allow the progressive nature of the condition to be fully captured. The same model was used to evaluate two time horizons of three and five years, and two populations of patients, those with severe resting hypoxaemia and those with significant nocturnal desaturation. The author reported that a third-party payer perspective (Medicare) was used.

Effectiveness data:
The evidence was derived from published literature. Traditional bibliographic databases were searched and two studies were selected for each of the patient groups, to derive the effectiveness estimates. The data extracted from these studies included the distribution of initial disease states (the percentage of the initial cohort with stage one, two, or three disease), the quarterly probabilities of transition between states, and the death rates. The model assumed that the forced expiratory volume in the first second of expiration declined over time.

Monetary benefit and utility valuations:
The utilities for the different states were from published literature.

Measure of benefit:
Quality-adjusted life-years (QALYs) were the measure of benefit. The long-term benefits were discounted at a rate of 3%.

Cost data:
The monthly costs of the long-term oxygen therapy, including the electricity costs of running an oxygen concentrator, were analysed. The data were from Medicare reimbursement rates. Future costs were discounted at an annual rate of
3%. The currency was US dollars ($) and the price year was 2007.

Analysis of uncertainty:
One-way sensitivity analyses were performed to assess the impact of variations in the key model inputs. Probabilistic sensitivity analysis, based on the underlying parameter distributions, was conducted. The 95% confidence interval ellipses for the cost-effectiveness ratio were presented.

Results
In the severe resting hypoxaemia cohort, the QALYs at five years were 2.07 in the control group and 2.66 in the continuous long-term oxygen therapy group. The incremental costs of continuous oxygen therapy at five years were $9,517, and the incremental cost per QALY was $16,124. The estimates at three years for the same population produced an incremental cost-effectiveness ratio (ICER) of $23,807.

In the nocturnal desaturation cohort, the QALYs at five years were 2.68 in the control group and 2.70 in the nocturnal long-term oxygen therapy group. The incremental costs of nocturnal oxygen therapy at five years were $8,615, with an ICER of $306,356. The estimates at three years for the same population produced an ICER of $477,929.

The one-way sensitivity analyses showed that the results were robust, except when nocturnal oxygen therapy was assumed to produce mortality benefits; in this case it was cost-effective. The three and five year 95% ellipses for continuous oxygen therapy were below the willingness-to-pay per QALY threshold of $50,000. The nocturnal oxygen therapy ICER was more than $100,000 in a large proportion of the two 95% ellipses.

Authors' conclusions
The author concluded that continuous oxygen therapy for COPD was cost-effective, while nocturnal oxygen therapy was not.

CRD commentary
Interventions:
The interventions were described, and seem to have been relevant for the health conditions. The two interventions were separately compared with control. The control treatment was not clearly reported, but was likely to have been no oxygen therapy. It was not clear if other non oxygen-related interventions were valid comparators, but other interventions appear to have been available and might have been viable alternatives to oxygen therapy.

Effectiveness/benefits:
The main benefits were estimated using a non-systematic literature review. Relevant sources appear to have been included, but the sources searched, the inclusion criteria, and a quality assessment were not reported, making it impossible to ascertain if all the available evidence was appropriately considered and included. The utility values were reported to have been from one published source, but this was not described sufficiently to allow a judgement of the validity of the estimates used.

Costs:
The only costs included were those of nocturnal and continuous long-term oxygen therapy, from a third-party payer’s perspective. No cost for the control group was reported, which suggests that the costs were not those of all treatment, but were the additional costs of oxygen therapy over the standard care package. This standard care was not discussed nor outlined. Some of the omitted costs might have been important as oxygen therapy could require more visits for monitoring, or fewer visits or hospitalisations due to its benefits. The author stated that the exclusion of avoided hospitalisation could produce a conservative result, but additional future costs would partly counterbalance this.

Analysis and results:
A reasonable summary of the model and the key assumptions behind the data were given, but the lack of reporting of the methods of identification and retrieval of the evidence and the information to allow a quality assessment limits the reliability of the results obtained. The author undertook a number of one-way and probabilistic sensitivity analyses, which went some way towards assessing the uncertainty present in the data. The reporting of these analyses was not clear enough to be sure that all parameters were assigned probability distributions, particularly the utilities. The author
acknowledged a number of limitations to the analysis and highlighted the fact that the results were mainly applicable to Medicare.

Concluding remarks:
There were a number of limitations to the study and these should be carefully considered when interpreting the author’s conclusions.

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