Cost-utility analysis of telemedicine and ophthalmoscopy for retinopathy of prematurity management


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 determine whether telemedicine was a cost-effective strategy for the management of retinopathy of prematurity compared with standard ophthalmoscopy. The authors concluded that telemedicine was more cost-effective than standard ophthalmoscopy. Overall, the methodology appeared to be satisfactory, but it is difficult to assess the validity of the authors' conclusions due to the inadequate reporting of the results and lack of incremental analysis.

Type of economic evaluation
Cost-utility analysis

Study objective
The objective was to determine whether telemedicine was a cost-effective strategy for the management of retinopathy of prematurity for infants with a birth weight less than 1500g.

Interventions
The telemedicine consisted of an examination by non-ophthalmic personnel using wide-angle imaging devices and interpretation by an ophthalmologist at a remote location. This was compared with standard ophthalmoscopy and no intervention, for all cases of type two pre-threshold disease or worse.

Location/setting
USA/secondary care.

Methods
Analytical approach:
The authors used a decision-tree model to determine the proportions of the population in specified health states following diagnosis and treatment. A specified life expectancy for all patients was assumed, and the analysis was performed from the third-party payer perspective.

Effectiveness data:
The sensitivity and specificity of the different diagnostic techniques were obtained from observational studies. The incidence and visual outcome data were obtained from randomised controlled trials. The main clinical parameters were the sensitivity and specificity of the diagnostic techniques of retinopathy of prematurity, and the visual acuity with an associated utility value.

Monetary benefit and utility valuations:
The utility estimates were derived from the visual acuities outcome data from three published studies, using a conversion formula reported in another published study (Brown. 1999, see 'Other Publications of Related Interest' below for bibliographic details).

Measure of benefit:
The measure of benefit was quality-adjusted life-years (QALYs) gained and these were discounted at an annual rate of 3%.
Cost data:
The direct costs included technical and professional fees for fundus photography for the intervention, and costs of ophthalmoscopy which included in-patient consultation, hospital care, extended ophthalmoscopy, and laser retinal photocoagulation. These costs were based on 2006 Medicare reimbursements, and determined by multiplying a 2006 conversion factor by the relative value unit of particular Current Procedural Terminology code. The currency was US dollars ($).

Analysis of uncertainty:
One-way sensitivity analysis was used to assess the impact of changes in baseline values of discount rate, incidence rates, sensitivity and specificity of treatment decisions, and the percentage of readable images, on the modelled outcomes.

Results
The lifetime cost per QALY gained, in infants with a birth weight of less than 1500g, were $3,193 (QALY gain of 0.1525 at a cost of $487) for telemedicine and $5,617 (QALY gain of 0.1150 at a cost of $646) for standard ophthalmoscopy, compared with no intervention.

One-way sensitivity analyses found the cost per QALY to vary from $1,235 to $18,898 for telemedicine and $2,171 to $27,215 for standard ophthalmoscopy, however telemedicine remained more cost-effective for all variations of the variables tested.

Authors’ conclusions
The authors concluded that telemedicine was more cost-effective than standard ophthalmoscopy for the management of retinopathy of prematurity.

CRD commentary
Interventions:
Both interventions were well described. The analysis included the current practice, where patients would be treated with standard ophthalmoscopy.

Effectiveness/benefits:
The effectiveness data were derived from a number of published studies, and the authors provided some information and detail on these. The relevant references were also provided, but the methods used to identify the studies were not reported, making it difficult to ascertain if the best available evidence was used. The methods used to derive the utility estimates were reported, but the instrument and the sample population used to derive the conversion method were not. The reader should consider whether all the relevant health outcomes, for example adverse events, were considered. The lifetime time horizon was adequate to capture the differences in health outcome.

Costs:
The authors reported the perspective and appeared to include the relevant costs. All costs were assumed to be incurred immediately and therefore were not discounted. The costs were calculated for a base year.

Analysis and results:
The analytical approach was adequately reported and the model structure was reported in full with a diagram. The reporting of the results was very brief and unclear. The authors presented the cost per QALY estimates within the treatment options and did not make a direct comparison with the alternatives using an incremental cost-effectiveness ratio. The lack of direct comparisons means that true relative cost-effectiveness of the two interventions was not calculated. Telemedicine appeared to be cheaper and more beneficial than standard ophthalmoscopy, but the authors did not discuss this and did not provide any data to explain why this treatment appeared to be cheaper. One-way sensitivity analyses were performed and reported. This type of analysis addresses a degree of parameter uncertainty, but the use of multivariate or probabilistic sensitivity analysis would have been a more thorough way to fully capture parameter uncertainty. The sensitivity analysis did not assess the impact on the relative cost-effectiveness of the two interventions. The authors acknowledged and highlighted some of the limitations of their study.
Concluding remarks:
Overall, the methodology appeared to be satisfactory, but the reporting of the results was very brief and inadequate. The results were difficult to interpret, but the sensitivity analysis suggested that they were consistent when the parameter estimates were varied. It is difficult to assess the appropriateness of the authors' conclusions, given the inadequate reporting of the results and lack of incremental analysis.

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