Cost-effectiveness of continuous glucose monitoring and intensive insulin therapy for type 1 diabetes

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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 study evaluated the cost-effectiveness of continuous glucose monitoring with intensive insulin therapy for type 1 diabetes patients compared with self-monitoring of blood glucose. The authors concluded that continuous monitoring was a cost-effective choice. The methods were good and the results were well reported but the validity of the model inputs could not be assessed. The authors’ conclusions seem reasonable, but uncertainty around the results should not be ignored.

Type of economic evaluation
Cost-utility analysis

Study objective
To evaluate the cost-effectiveness of continuous glucose monitoring with intensive insulin therapy for patients with type 1 diabetes.

Interventions
Continuous glucose monitoring with intensive insulin therapy in addition to self-monitoring was compared with self-monitoring of blood glucose alone in adult patients with type 1 diabetes who received intensive insulin therapy.

Location/setting
USA/primary care

Methods
Analytical approach:
The analysis used a Markov simulation model with a 33-year time horizon to simulate the impact of treatment of the progression of diabetes complications. The perspective was societal.

Effectiveness data:
Clinical data came from a selection of known relevant studies. Evidence on glycaemic control for patients who used continuous glucose monitoring technology came from a published study (see Other Publications of Related Interest). Further data such as patients’ characteristics, risk reduction and transition probabilities came from various published articles.

Monetary benefit and utility valuations:
The utility valuations were derived from a USA-based study that used an EQ-5D approach.

Measure of benefit:
The summary benefit measure was quality-adjusted life-years (QALYs). These were discounted at an annual rate of 3%.

Cost data:
The cost analysis considered continuous glucose monitoring technology and included initial and annual costs and the treatment of diabetes and its complications. Annual costs of complications (blindness, coronary heart disease, end-stage renal failure, lower extremity amputation, nephropathy and retinopathy) were presented as an aggregate cost and
included hospital in-patient visits, nursing facility visits, physician visits, emergency department visits, hospital outpatient visits, home health care, podiatry care, insulin, diabetic supplies, oral agents, retail prescriptions, other supplies and patient time. Lost wages were used as a proxy for patient time. Cost data for continuous glucose monitoring technology came from a purchasing website. Treatment costs were from the American Diabetes Association (ADA). All costs were in US dollars ($). Costs were discounted at an annual rate of 3%. The price year was 2007.

Analysis of uncertainty:
Probabilistic sensitivity analysis with Monte Carlo simulation was performed to investigate parameter uncertainty. A one-way sensitivity analysis was performed by varying model inputs such as utility scores, costs and transition probabilities.

Results
Self-monitoring resulted in a total cost of $470,583 and total QALYs of 10.289.

Continuous glucose monitoring and self-monitoring resulted in a total cost of $494,135 and total QALYs of 10.812, generating incremental QALYs of 0.52 and an incremental cost of $23,552. The incremental cost-effectiveness ratio was $45,033/QALY.

Probabilistic sensitivity analysis suggested that for continuous glucose monitoring and self-monitoring 48% of the observations were cost-effective at a willingness-to-pay threshold of $50,000 per QALY and 70% at a threshold of $100,000 per QALY.

Authors’ conclusions
The authors concluded that the continuous glucose monitoring with self-monitoring was cost-effective.

CRD commentary
Interventions:
Self-monitoring was an appropriate comparator. The two monitoring strategies reflected the possible options in the setting for patients with type 1 diabetes.

Effectiveness/benefits:
The authors identified appropriate sources of data, but it was unclear whether all available data were included in their analysis. Limited information was provided on the methods used to identify and select data sources, which made it impossible to know whether all of the best available evidence was identified and used. The clinical benefit was reduction of A1c levels for patients who used continuous glucose monitoring technology, the value of which came from a published study. The details of this study were not reported, so its internal validity could not be assessed. Very limited details of other sources of data were provided. The source of the utility valuations was reported and the measurement tool used, but insufficient detail was presented to allow the reader to compare the populations. QALYs were an appropriate benefit measure.

Costs:
The cost categories were consistent with the economic viewpoint of the study. Costs were presented as macro-categories. The sources of cost data were reported clearly and reflected the USA setting. Other characteristics of the economic analysis (such as price year and use of discounting) were reported explicitly. Additional information on continuous glucose monitoring utilisation and unit costs were presented in an appendix with slightly more detailed costing tables; these additional data aided transparency and generalisability.

Analysis and results:
The analysis appropriately utilised a Markov simulation model. The authors developed their own model rather than use an existing validated model and a clear justifiable rational for this choice was presented. Costs and benefits were appropriately synthesised by means of an incremental analysis. The issue of uncertainty was addressed satisfactorily using a comprehensive approach and results were reported clearly. The authors noted and discussed limitations of their study.

Concluding remarks:
The methods were good and the results were well reported. The validity of the model inputs could not be assessed. The authors' conclusions seem reasonable, but uncertainty around the results should not be ignored.

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