Self-monitoring of blood glucose (SMBG) for type 2 diabetes patients treated with oral anti-diabetes drugs and with a recent history of monitoring: cost-effectiveness in the US

Tunis SL, Minshall ME

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 examined the cost-effectiveness of self-monitoring of blood glucose once, twice, or three times per day, for patients with type 2 diabetes, who were on oral antidiabetic drugs and had self-monitored in the previous year. Monitoring modestly improved the clinical outcomes and its costs were partly offset, with incremental cost-effectiveness ratios below 30,000 US dollars. The cost-effectiveness framework was conventional, but more extensive reporting of the data sources would have been useful. The authors’ conclusions appear to be appropriate.

Type of economic evaluation
Cost-utility analysis

Study objective
The study examined the cost-effectiveness of self-monitoring of blood glucose once, twice, or three times per day for patients with type 2 diabetes who were treated with oral antidiabetic drugs and who had used self-monitoring in the previous year (a population of prevalent users).

Interventions
The strategies were once, twice, or three times per day self-monitoring of blood glucose versus no self-monitoring.

Location/setting
USA/primary care.

Methods
Analytical approach:
The economic evaluation was based on a published Markov model, namely the IMS Center for Outcomes Research (CORE) Diabetes Model. The time horizon was 40 years and the authors stated that the analysis was carried out from the perspective of the third-party payer.

Effectiveness data:
The clinical evidence came from a selection of published studies. The key evidence for the baseline characteristics of the patient population and the self-monitoring efficacy was obtained from an observational study by Kaiser Permanente (Karter, et al. 2006, see ‘Other Publications of Related Interest’ below for bibliographic details). Other US epidemiological and clinical data were from the National Health and Nutrition Examination Survey (NHANES). The transition probabilities were already incorporated in the model and were from published sources. Some assumptions were required for the long-term efficacy of self-monitoring.

Monetary benefit and utility valuations:
The utility values were based on the UK Prospective Diabetes Study, along with data from other published sources.

Measure of benefit:
Quality-adjusted life-years (QALYs) were the summary benefit measure and they were discounted at an annual rate of 3%. Life-years gained were also presented, but were not combined with costs.

Cost data:
The economic analysis included the costs of self-monitoring (patient education and training, strips, and lancets) and of treatment and complications related to diabetes (cardiovascular, renal disease, eye problems, ulcers, and neuropathy). The self-monitoring costs were from Medicare reimbursements, while the complication costs were based on published data. All costs were in US dollars ($) and the price year was 2006. A 3% annual discount rate was applied.

Analysis of uncertainty:
A Monte Carlo simulation, based on nonparametric bootstrapping, was carried out to generate the mean costs and QALYs as well as cost-effectiveness acceptability curves. A deterministic analysis was performed on the discount rates for costs and benefits (using 0% and 6%) and on the time horizon (using five and 10 years).

Results
In comparison with no monitoring, the additional costs were $1,225 with self-monitoring once per day, $2,147 with self-monitoring twice per day, and $3,349 with self-monitoring three times per day. The QALYs were 0.047 for once per day, 0.116 for twice per day, and 0.132 for three times per day. The incremental cost per QALY gained with self-monitoring was $26,208 for once per day, $18,572 for twice per day, and $25,436 for three times per day.

These results were sensitive to changes in the time horizon, with unfavourable results (self-monitoring not cost-effective at a threshold of $50,000 per QALY) associated with the shorter time horizons of five or 10 years.

Authors' conclusions
The authors concluded that self-monitoring led to a modest improvement in the clinical outcomes and its costs were partly offset by a reduction in complications, resulting in incremental cost-effectiveness ratios that were below $30,000.

CRD commentary
Interventions:
The selection of the comparators was appropriate as the three monitoring strategies were compared against no monitoring.

Effectiveness/benefits:
The selection of sources was appropriate as the authors considered relevant studies for their setting, but limited information was provided on these sources. The treatment effect and patients' baseline characteristics were based on a large observational study that was open to the risk of confounding associated with a non-randomised trial, but several multivariate analyses were conducted to minimise this risk. Few details of the other sources were given, which makes it difficult to fully assess the validity of the clinical inputs. Limited details of the derivation of the utility values were also provided. QALYs were a valid benefit measure, due to the impact of diabetes on a patient's survival and quality of life. They can also be compared with the benefits of other health care interventions.

Costs:
The categories of costs were consistent with the viewpoint. Disease-related costs were presented as total categories and neither the unit costs nor the resource quantities were given. These were reported for some of the costs for monitoring. The methods used, in the study from which the diabetes-related costs were derived, were not clearly described, limiting the transparency of the analysis. The cost estimates appear to have been treated deterministically and alternative assumptions were not considered in the sensitivity analyses.

Analysis and results:
The results were clearly presented and the uncertainty was assessed, using two approaches (probabilistic and deterministic). The findings of the sensitivity analyses were clearly discussed, but they focused only on a few inputs (discount rate and time horizon) and did not consider other areas of uncertainty. The decision model had been validated and was a valid instrument for the long-term assessment of outcomes in diabetic patients. An incremental analysis comparing the self-monitoring strategies with each other, rather than against no monitoring, would have been useful. Assumptions for the long-term effect of self-monitoring were made, but were not tested in the sensitivity analysis. The authors compared their results with those of other published studies and explained the reasons for different findings.

Concluding remarks:
The study had a conventional cost-effectiveness framework, but a more extensive reporting of the data sources would have been useful. In general, the authors' conclusions appear to be appropriate.

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