Self-monitoring of blood glucose in type 2 diabetes: cost-effectiveness in the United States

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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 examined the cost-effectiveness of self-monitoring of blood glucose (SMBG) once or three times per day for patients with type two diabetes mellitus who were treated with oral antidiabetic medications. It was found that both the once per day and three times daily SMBG strategies were cost-effective alternatives to no SMBG, from the perspective of the US public payer. The study was based on valid methodology and was extensively described. The authors’ conclusions are valid and robust.

Type of economic evaluation
Cost-utility analysis

Study objective
This study examined the cost-effectiveness of self-monitoring of blood glucose (SMBG), once or three times per day, for patients with type two diabetes mellitus (T2DM), who were treated with oral antidiabetic (OAD) medications, in comparison with no SMBG.

Interventions
The health interventions were SMBG once or three times daily versus no SMBG. Only those patients with T2DM, who were taking OAD medications and beginning SMBG were considered in the study.

Location/setting
USA/primary care.

Methods
Analytical approach:
This economic evaluation was based on a published and validated decision model using Markov cycles (namely, the CORE Diabetes Model) with a 40-year time horizon. The authors stated that the perspective of the US public health care payer was adopted.

Effectiveness data:
The clinical data came from a selection of known, relevant studies. Evidence on glycaemic control with SMBG and some baseline characteristics of the hypothetical cohort of patients came from a large-scale (more than 3,000 patients), three-year observational study by the Kaiser Permanente Healthcare Group. Further data on the patients’ characteristics came from the National Health and Nutrition Examination Surveys (NHANES) and from five other published papers, the details of which were not given. The transition probabilities for disease progression were taken from the original model.

Monetary benefit and utility valuations:
The utility valuations were derived from the United Kingdom Prospective Diabetes Study (UKPDS) supplemented with data from other published sources, the details of which were not given.

Measure of benefit:
Quality-adjusted life-years (QALYs) were used as the summary benefit measure. They were discounted at an annual rate of 3%. The undiscounted life expectancy and the number of diabetes complications were also reported, but were not combined with costs.
Cost data:
The analysis of costs included those of SMBG (strips and lancets as well as a one-hour training course) and treatment of both diabetes and its complications. The costs related to diabetes came from published studies and other sources such as average wholesale prices. The cost of monitoring was based on Medicare reimbursement rates. The sources of resource use data were not clearly reported for all items. All costs were in US dollars ($). Future costs were discounted at an annual rate of 3% and the price year was 2006.

Analysis of uncertainty:
First- and second-order Monte Carlo simulations were performed to provide point estimates for the model outputs and to generate cost-effectiveness acceptability curves (CEACs) for several thresholds of willingness to pay. In a deterministic sensitivity analysis, alternative assumptions on discount rates and time horizons were considered. Finally, additional scenarios were simulated to consider compliance rates lower than 100% (the base-case value).

Results
SMBG reduced the number of diabetes complications, especially end-stage renal disease.

In comparison with no SMBG, the once daily SMBG strategy led to 0.103 additional QALYs and $808 additional costs, resulting in an incremental cost per QALY gained of $7,856. The three times daily SMBG strategy led to 0.327 additional QALYs and $2,161 additional costs, resulting in an incremental cost per QALY gained of $6,601.

The CEAC showed that, at a threshold of $50,000 per QALY, the probability of SMBG being cost-effective over no SMBG was 52.6% for once per day and 60.7% for three times per day. Even at lower thresholds, the likelihood of SMBG being cost-effective was above 50% for both strategies.

The univariate sensitivity analysis indicated that the model findings were sensitive to variations in the time horizon (a shorter study period led to higher cost-utility ratios) and the compliance rate (the lower the compliance, the higher the cost-utility ratios). However, in all cases the incremental cost per QALY for both once and three times daily SMBG remained below $30,000.

Authors' conclusions
The authors concluded that a strategy of once or three times daily SMBG was a cost-effective alternative to no SMBG in T2DM patients from the perspective of the US public payer.

CRD commentary
Interventions:
The selection of no intervention as the comparator was appropriate for assessing the additional value of SMBG. The inclusion of two monitoring strategies reflected the possible options for this specific population of patients.

Effectiveness/benefits:
The authors identified the most appropriate sources of data from among the available studies. The use of a large-scale longitudinal study and the NHANES appears to have been appropriate since such sources reflect the real-world management of T2DM patients. The details of the other sources of data were not provided. However, most of these data came from a validated and well-known diabetes model, and this represents a strength of the analysis. Moreover, because the bulk of the evidence came from the large cohort study, the authors did not address the issue of mixing data from multiple sources. The derivation of the utility valuations was reported. In general, the UKPDS represented a validated source of data. QALYs are an appropriate benefit measure, which is comparable with the benefits of other health care interventions.

Costs:
The categories of costs were consistent with the economic viewpoint of the study. Most of the costs were presented as macro-categories related to the health conditions (diabetes-related complications). These categories of costs were not broken down into individual items. This was due to the fact that these costs were derived from published studies. The sources of other costs were reported and appear to have reflected the US payer's perspective. Other characteristics of the economic analysis such as the price year, use of discounting and the model assumptions were explicitly reported.
Analysis and results:
The synthesis of the costs and benefits was appropriately carried out by means of an incremental analysis. The issue of uncertainty was satisfactorily addressed using a comprehensive approach. The results of the study were extensively presented and discussed. The decision model used to predict the long-term clinical and economic impact of the interventions had been validated in several studies. In general, the study was carried out in a credible and transparent fashion. The authors noted some potential limitations of their study. First, the main source of evidence included a large group of SMBG "new users", which might not be representative of all T2DM patients. Second, caution will be required if extrapolating the study findings to less or more severe clinical cohorts.

Concluding remarks:
The study was based on a valid methodology and was extensively described. The authors’ conclusions are valid and robust.

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Other publications of related interest


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