The value of self-monitoring of blood glucose: a review of recent evidence

St John A, Davis WA, Price CP, Davis TM

CRD summary
The review found a modest overall reduction in HbA1c associated with self monitoring blood glucose in type 2 diabetes in studies that were largely of patients treated with diet or other glucose-lowering mechanisms. Potential for publication and language biases, lack of reporting of review methods, validity assessment and clarity regarding the analysis mean the authors’ conclusions may not be reliable.

Authors’ objectives
To investigate whether self-monitoring of blood glucose leads to improved glycaemic control.

Searching
MEDLINE and EMBASE were searched between 1996 and 2008. Search terms were reported. Reference lists of retrieved papers were scanned for additional studies.

Study selection
Experimental and observational studies that evaluated the effect of self-monitoring blood glucose on glycaemic control of participants with type 1 or 2 diabetes regardless of treatment were eligible for inclusion. Eligible studies had to report HbA1c as an outcome. Studies could include self-monitoring blood glucose alone or as part of an education program. Studies of case reports and studies of pregnant women were excluded.

Interventions included self-monitoring of blood glucose alone or as part of an educational intervention or better access to glucose meters. Control groups, where present, were usual care. Intensity of monitoring varied between studies. Patients included in the review were treated with insulin, oral blood glucose lowering medication, diet or a combination of treatments. Baseline HbA1c levels and duration of diabetes varied widely between studies. Most of the included studies were of patients with type 2 diabetes; other studies evaluated patients with type 1 diabetes, a combination of type 1 and 2 or did not report type.

The authors did not state how many reviewers selected studies for inclusion.

Assessment of study quality
The authors did not state that they assessed validity.

Data extraction
Data were extracted for changes in HbA1c from baseline to endpoint for intervention and control groups and used to calculate the mean difference (MD) and corresponding 95% confidence intervals (CIs). Standard deviations (SDs) were estimated where missing from the data.

The authors did not state how many reviewers performed data extraction.

Methods of synthesis
Data were grouped by study design. Data were pooled for RCTs using fixed-effect and random-effects models. Heterogeneity was assessed using Cochran's Q test and I². Publication bias was assessed by visual inspection of funnel plots and using Egger's test. Sensitivity analyses were conducted including: studies that were of "doubtful eligibility"; excluding the largest trial; and grouping trials by duration (less than one year or one year or more). Data from other study designs were described narratively.

Results of the review
Thirty-eight studies (more than 107,168 participants) were included in the review: 13 RCTs (two from a previous review), one controlled trial, five before-and-after studies, one interrupted time series, 16 cross-sectional studies and
two cohort studies.

**Effects on Type 2 diabetes** (23 studies): Pooled analysis reported a significant decrease in HbA1c following self-monitoring of blood glucose levels as part of usual care compared to usual care without self-monitoring blood glucose for non-insulin treated patients with type 2 diabetes (MD -0.22%, 95% CI -0.34% to -0.11%; seven RCTs). There was no evidence of statistical heterogeneity ($I^2=0\%$). There was no evidence of publication bias for this analysis ($p=0.60$). Results of the analysis stratified by intervention duration reported a similar effect for studies of less than one year duration (five RCTs); studies of one year or more showed no statistically significant differences between groups (two RCTs). The other sensitivity analyses reported results similar to the main analyses.

Three before-and-after studies and one interrupted time series study reported increased self monitoring of blood glucose and decreased HbA1C after the intervention. Seven out of 13 cross-sectional or longitudinal surveys reported a link between use of self-monitoring blood glucose and improvement of glycaemic control.

**Effects of Type 1 diabetes** (seven studies): For type 1 diabetes, mixed results were reported for five cross-sectional studies that evaluated the effect of self-monitoring blood glucose levels on HbA1c. Two before-and-after studies reported an increase in self-monitoring blood glucose and a reduction in HbA1c levels following the intervention.

Eight studies (seven RCTs and one controlled trial) that included patients with type 1 and type 2 diabetes or where type was not specified were included. Results were not reported for these studies.

**Authors' conclusions**
A modest overall reduction in HbA1c was associated with self monitoring blood glucose use in type 2 diabetes. Studies were largely of patients treated with diet or other glucose-lowering mechanisms.

**CRD commentary**
The review question was clear with appropriate inclusion and exclusion criteria. Some relevant sources were searched. It was unclear whether there was potential for language bias. It appeared that only published studies were sought and there was a risk of publication bias. Formal assessment of publication bias found no evidence of it in the meta-analysis, but this included only a small proportion of the included studies and may not have been an accurate reflection. Study validity was not assessed and so results from these studies and any synthesis may not have been reliable. The authors did not report whether they took appropriate steps to reduce reviewer error and bias in the review process.

A small number of RCTs were combined in a meta-analysis. The authors included two RCTs from a previous review with publication dates prior to 1996 (outside the dates of the search for this review). It was unclear why the authors chose to include the two studies from the previous review and whether other trials which were excluded. The authors did not report any details of the two additional studies so it is unclear whether their inclusion is appropriate. The remaining studies appeared to be single-group studies and so liable to multiple biases. Some relevant study details were reported. Few details of participants were reported, which made it difficult to judge the generalisability of the results.

Potential for publication and language bias, lack of reporting of review methods, lack of validity assessment and lack of clarity regarding the analysis mean the authors’ conclusions may not be reliable.

**Implications of the review for practice and research**

**Practice:** The authors did not state any implications for practice.

**Research:** The authors stated that further robust long-terms trials were needed to determine where in the process from performance and interpretation of self-monitoring blood glucose and the application of the result to self-management, improved education and motivation would produce the greatest benefit.

**Funding**
Not stated.