Self-monitoring of blood glucose levels in patients with type 2 diabetes mellitus not taking insulin: a meta-analysis


CRD summary
The review found a statistically significant but clinically modest effect for self-monitoring of blood glucose levels in the control of blood glucose levels in patients with type 2 diabetes mellitus not taking insulin. The limited search strategy and general low quality of the included studies made it difficult to determine the reliability of the authors’ conclusion.

Authors’ objectives
To evaluate the efficacy of self-monitoring of blood glucose levels (SMBG) among patients with type 2 diabetes mellitus not taking insulin.

Searching
PubMed was searched from September 2004 to July 2007. Search terms were reported. Reference lists from reviews and retrieved articles were scanned for additional articles.

Study selection
Randomised controlled trials (RCTs) and controlled clinical trials (CCTs) that evaluated the efficacy of SMBG alone or as part of a multi-component intervention compared to no SMBG and which measured glycosylated hemoglobin (A1C) levels with a follow-up of 12 weeks or longer were eligible for inclusion.

Interventions in the included studies included SMBG together with counselling and education for most of the studies. Other studies included dietician visits, exercise, carbohydrate counting and financial incentives. Duration of treatment ranged from four months to 62 weeks. The mean age of participants included in the review ranged from 50 years to 66 years. The proportion of women ranged from 42 per cent to 78 per cent. Duration of diabetes ranged from three years to 13 years. Mean weight ranged from 73 kg to 99 kg. Outcomes evaluated in the included studies were A1C, fasting glucose, body mass index (BMI), weight loss, health-related quality of life (HRQOL) and adverse events.

Two reviewers independently selected studies. Methods used to resolve disagreements were not reported.

Assessment of study quality
Validity was assessed using the Delphi checklist and assessed: treatment allocation; method of randomisation; comparability at baseline regarding prognostic indicators; eligibility criteria; blinding of outcome assessor; care provider and patient; presentation of point estimates and measures of variability; and intention to treat (ITT) analysis. The authors did not state how the validity assessment was performed or how many reviewers performed the assessment.

Data extraction
Data on mean A1C levels and standard deviations (SD) were extracted for each treatment arm for each reported follow-up point. Data were calculated for studies that did not report SD for A1C level by using the weighted mean SD across all other studies which reported SDs. Data on adverse events were also extracted. Two reviewers independently extracted data. Disagreements were resolved through discussion.

Methods of synthesis
The pooled mean difference and 95% confidence intervals (CI) were calculated by follow-up duration (three to six months, six to 11 months and 12 months or longer) using the DerSimonian and Laird random-effects model. A pooled estimate stratified by high-quality and low-quality studies was calculated. Meta-regression analyses were conducted to examine the effect of treatment frequency, quality score and mean baseline A1C level on mean difference. A sensitivity analysis was conducting controlling for baseline mean A1C levels for each group. Heterogeneity was assessed using the I^2 statistic. Publication bias was evaluated using the Begg rank correlation and Egger regression asymmetry test.
Results of the review
Nine RCTs (n= at least 1,862) were included in the analysis. The methodological quality of the included RCTs varied with the majority of studies scoring less than half the criteria.

Improving Glycaemic Control
Three RCTs reported A1C levels at three months. Due to the presence of statistical heterogeneity (I² statistic = 67%) these results were not pooled.

There was a significant reduction at six months in mean A1C of -21 per cent (95% CI: -0.38%, -0.04%) for participants in the SMBG group compared to control group (five RCTs). There were no statistically significant differences in mean A1C at one year between groups (four RCTs). There was no evidence of statistical heterogeneity for these analyses.

Subgroup analysis found no statistically significant differences in results between high-quality and low-quality RCTs or for analyses adjusted for baseline A1C levels. Meta-regression analysis found higher baseline A1C levels were associated with lesser efficacy of SMBG (p=0.06). There was no evidence of publication bias.

Hypoglycaemia
SMBG was associated with an increase in the frequency of recognised hypoglycaemia in three RCTs.

Authors' conclusions
Results showed that SMBG produced a statistically significant but clinically modest effect in reducing A1C levels in patients with DM not taking insulin. The value of the evidence is questionable with regard to helping to meet target values of glucose control.

CRD commentary
Inclusion criteria were clear for intervention, participants, outcomes and study design. Only one database was searched and this may have resulted in the omission of other relevant studies. It was unclear whether language restrictions were applied and so the potential for language bias could not be assessed. Limited attempts were made to locate unpublished studies. The authors assessed the possibility of publication bias and no evidence was found, although data were not reported. Appropriate methods were used to minimise reviewer errors and bias in the selection of studies and extraction of data, but it was unclear whether similar steps were taken in assessment of validity. Validity was assessed using specified criteria and general results of the assessment were reported. Statistical heterogeneity was assessed and where evidence was found the results of these studies were not pooled. The method used to combine the remaining studies appeared appropriate. Findings were based on a small number of studies with most having small sample sizes, so the statistical power of the meta-analyses to detect a difference between treatment groups was unclear. The authors commented appropriately that because education and counselling components were included in a large number of studies it was not possible to distinguish the effects of SMBG alone. The limited search strategy and and general poor quality of the included studies made it difficult to determine the reliability of the authors’ conclusion.

Implications of the review for practice and research
Practice: The authors stated that patients, providers and health plans needed to look elsewhere for interventions which have the required effectiveness of achieving target values of A1C levels.

Research: The authors did not state any implications for research.

Funding
Department of Veterans Affairs Health Services Research and Development Evidence Synthesis Activity Pilot Program Project ESP 05-226.

Bibliographic details
Record Status
This is a critical abstract of a systematic review that meets the criteria for inclusion on DARE. Each critical abstract contains a brief summary of the review methods, results and conclusions followed by a detailed critical assessment on the reliability of the review and the conclusions drawn.