Self-management education for adults with type 2 diabetes: a meta-analysis of the effect on glycemic control

Authors' objectives
To assess the effect on glycated haemoglobin (GHb) of diabetes self-management education (DSME) for adults with type 2 diabetes mellitus.

Searching
MEDLINE (from 1980 to December 1999), ERIC (from 1980 to 1999) and CINAHL (from 1982 to 1999) were searched for studies published in the English language; the search terms were stated. Abstracts and dissertations were not included. Journals of most relevance were handsearched and experts in the field were contacted for additional reports.

Study selection
Study designs of evaluations included in the review
Randomised controlled trials (RCTs) were eligible for inclusion. Two studies that met the inclusion criteria were excluded from the meta-analysis: one because of a lack of measure of variation in GHb and the other due to atypically intensive intervention for both treatment arms.

Specific interventions included in the review
Studies of DSME were eligible for inclusion. Interventions were eligible regardless of setting, provider type, medium, basis (group or individual), duration or intensity. Studies that used co-interventions were only included if it was possible to determine the effects of the educational component separately. Of the included studies, most were conducted in clinics, home or senior centres, and most focused on lifestyle changes (diet and physical activity) and knowledge (one study focused only on skills). The duration of the interventions ranged from 1 to 27 months (median 6), the number of contacts ranged from 1 to 36 (median 6), and the total contact time ranged from 1 to 28 hours (median 9.2). The interventions were provided by a variety of people such as nurses, dieticians, physician with team, team, lay health care worker and self (using computer).

Participants included in the review
Studies in which all or most of the participants were adults (older than 18 years) with any severity of type 2 diabetes mellitus were eligible for inclusion. Studies that did not specify the type of diabetes mellitus but were in patients with a mean age of greater than 30 years were also included. Studies of patients with any co-morbidity were eligible. The included studies were of patients who were (16% of participants) or were not being treated with insulin. The mean age of the patients was 55 years and the mean baseline GHb was 9.4 (range: 6.1 to 12.9).

Outcomes assessed in the review
Studies that reported GHb (including HbA1 and HbA1c) were eligible for inclusion. The included studies used a variety of methods to measure GHb, e.g. ion-exchange and affinity chromatography.

How were decisions on the relevance of primary studies made?
The titles of identified studies were checked for relevance to diabetes education and full texts were obtained. The authors did not state how many reviewers performed the selection.

Assessment of study quality
Validity was assessed using the criteria described in the Cochrane Reviewers Handbook (see Other Publications of Related Interest). In addition, selection bias, attrition and detection bias were assessed. Attrition was considered to be potentially biased if the drop-out rate before data collection exceeded 20% of those recruited and the drop-outs either differed from completers or were not compared. The authors did not state how the papers were assessed for validity, or...
how many reviewers performed the validity assessment.

**Data extraction**

One reviewer extracted the data and a second reviewer checked the data. The data extractor was not blinded to the author or institution. Only data presented in the reports were included. The data extracted included: characteristics of the participants; diabetes treatment; baseline HbA1c; psychosocial variables; details of the intervention, e.g. the number of contacts, contact time, duration of the intervention, the person delivering and method of delivering the intervention; details of the control intervention; use of self-monitoring; type of health care system; and setting.

Data presented as HbA1 was converted to equivalent HbA1c where possible. The mean difference in HbA1c between the intervention and control groups was estimated for each study for three follow-up periods (immediately, 1 to 3 months, and at least 4 months after the intervention). Each study contributed only one result per follow-up period. Details of the methods used to estimate missing statistical data from whatever data were presented were reported. To estimate the variance of the difference in HbA1c between treatments, the correlation between baseline and follow-up HbA1c was required. None of the studies reported this value and, consequently, three different values were input for the correlation.

**Methods of synthesis**

How were the studies combined?
The pooled difference in HbA1c between the intervention and control groups was estimated using the random-effects model of DerSimonian and Laird for each of the three follow-up periods.

How were differences between studies investigated?
Statistical heterogeneity was tested using the chi-squared statistic. A sensitivity analysis was conducted using values of 0.25, 0.5 and 0.75 for the correlation between baseline and follow-up HbA1c in estimations of the variance of the difference between treatments. Studies that used only usual care as the control intervention were analysed separately.

A meta-regression was used to assess the influence on the results of the following: the time over which the intervention was delivered, the length of follow-up, the number of patient contacts, the total patient contact time, baseline HbA1c, treatment (insulin, diet only or oral hypoglycaemic agent), group versus individual intervention, age of the patient, person delivering the intervention, educational focus, follow-up interval, and setting (USA versus other countries). The meta-analysis was conducted with and without one study that was excluded from the main meta-analysis due to the use of an atypically intensive intervention for both treatment arms. Forest plots were presented for the change in HbA1c using a correlation of 0.5.

**Results of the review**

Thirty-one RCTs (4,263 patients) were included.

Compared with control interventions, DSME reduced HbA1c immediately after the intervention, at 1 to 3 months’ follow-up and at 4 or more months' follow-up. However, the difference in HbA1c at 1 to 3 months was not statistically significant. The decrease in HbA1c post-intervention (2,056 patients) was 0.76% (95% confidence interval, CI: 0.34, 1.18). Heterogeneity was significant (P<0.05). The decrease at 1 to 3 months (922 patients) was 0.26% (0.21% increase to 0.73% decrease). The decrease at 4 or more months (1,893 patients) was 0.26% (95% CI: 0.05, 0.48).

The results were similar for the subgroup of studies that used usual care with no additional intervention as the control.

The results were independent of the value used for the correlation between baseline and follow-up HbA1c.

The only variable found to significantly influence the results was the total contact time. The decrease in HbA1c was greater with increased contact time: from 15 studies with 21 HbA1c measurements, there was a decrease of 0.04% for every additional hour of contact time over the range of 1 to 28 hours.

There were insufficient data to assess the influence of psychosocial variables on HbA1c.
Authors' conclusions
Education in self-management improved GHb immediately after the intervention in patients with type 2 diabetes. In addition, increased contact time with patients decreased GHb. The results suggested there would be a decrease in GHb of 1% for every additional 23.6 hours of contact between the patient and educator.

CRD commentary
The review question was clear in terms of the study design, intervention, participants and outcomes. Several relevant sources were searched and the search terms were stated. By limiting the included studies to those in the English language, the authors may have omitted some relevant studies. No attempt was made to locate unpublished studies, thus introducing retrieval bias. The methods used to select the studies, assess validity and extract the data were not described; hence, efforts made to reduce errors and bias cannot be judged. Validity was assessed using validated criteria. Some relevant information on the individual studies was tabulated.

Attrition rates of greater than 20% in one third of the included studies were reported in the discussion, but it was not stated whether the data were extracted and analysed on an intention-to-treat basis. The studies were grouped by the length of follow-up and combined in meta-analysis. The text provided 'average' results, but it was unclear what these were the average of; they could have been the average of results obtained using three different values for the correlation. The forest plot using a correlation value of 0.5 showed significant heterogeneity (non overlapping 95% CI) for change in GHb but this was not highlighted in the 'Results' section; this suggests that a meta-analysis may not have been appropriate. The influence of several factors on the results was explored, but it was not stated whether any of these explained the heterogeneity. The authors discussed potential reasons for heterogeneity in the text of the review, but did not discuss the inappropriateness of a meta-analysis in the presence of significant heterogeneity. In view of the significant heterogeneity, the conclusion should be interpreted with caution.

Implications of the review for practice and research
Practice: The authors stated that interventions must involve adequate time spent with the patients to achieve clinically meaningful results.

Research: The authors stated that further research is required to determine effective methods for reducing GHb in the long term in patients with diabetes. They also stated that such research should use well-conducted and reported RCTs.

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