The effect of nurse-led diabetes self-management education on glycosylated hemoglobin and cardiovascular risk factors: a meta-analysis

CRD summary
The authors concluded that nurse-led diabetes self-management programmes were associated with improved glycaemic control, particularly in participants over 65 years and for follow-up periods of one to six months. Potential for bias in the review process, uncertainties regarding study quality and high levels of statistical heterogeneity mean that the authors' conclusions should be treated with caution.

Authors' objectives
To evaluate the impact of nurse-led diabetes self-management education programmes on blood glucose control and cardiovascular risk factors.

Searching
PubMed and ISIS Knowledge were searched for articles published between January 1999 and December 2009. Search terms were reported.

Study selection
Randomised controlled trials (RCTs) that evaluated structured nurse-led diabetes self-management education delivered to participants of any age with type I or II diabetes were eligible for inclusion. Programmes with additional multidisciplinary, family or physician support were included. Studies had to measure A1C levels before and after the education programme to be eligible for inclusion. The primary outcomes were within group absolute change in A1C and net difference in A1C. Secondary outcomes reported in the review were systolic blood pressure, diastolic blood pressure, body weight, total cholesterol, high-density lipoprotein cholesterol (HDL), low-density lipoprotein cholesterol (LDL) and triglycerides.

Most of the included studies delivered nurse-led multidisciplinary diabetes self-management programmes in consultation with physicians and patient families. Programmes usually consisted of four or six weekly sessions or intensive one or two day courses. Programmes consisted of education, discussions, sharing of personal experiences and practical demonstrations (such as food preparation). Groups were usually of no more than 10 patients. Most patients were aged between 18 and 65 years. Some studies focused specifically on seniors or children and adolescents. Mean duration of diabetes was 8.7 years and 65% of participants had type II diabetes. Forty seven per cent of participants were male. Baseline A1C ranged from 5.8% to 12.3%. Studies were conducted in USA, Canada, UK, Netherlands, Bulgaria, South Korea, Thailand, China, Germany, Taiwan, Brazil, Italy and Sweden.

The abstracts were reviewed by two reviewers.

Assessment of study quality
The authors did not appear to formally assess study quality. They reported on completeness of follow-up and length of follow-up for each study.

Data extraction
For within-group absolute change in A1C, A1C levels at baseline and after intervention were extracted for intervention and control groups. Net difference in A1C was calculated by taking the difference between intervention and control groups after intervention after accounting for baseline differences between groups. For each outcome, the effect size of studies with 95% confidence intervals (CI) was calculated using Hedges' g and Cohen's d.

Data were extracted by the review team.

Methods of synthesis
Pooled effect sizes with 95% CI were calculated using random-effect and fixed-effects models. Studies were weighted
Statistical heterogeneity was assessed using the Q test and quantified using the $I^2$ statistic. Subgroup analyses were conducted according to diabetes type, gender, age, baseline A1C (>8% versus ≤8%), duration of follow-up and study setting.

**Results of the review**

Thirty-four RCTs were included for review (5,993 participants). Participants of follow-up ranged from 54% to 100%. Twelve studies had follow-up of one to six months, 15 had follow-up from seven to 12 months and seven had follow-up of more than 12 months. Given the presence of significant statistical heterogeneity, pooled effect sizes reported below were for the random-effects models.

**Impact of diabetes self-management education on glycaemic control**

The mean absolute change in A1C was -0.7% (95% CI -0.95 to -0.45) with the intervention group compared to -0.21% (95% CI -0.48 to 0.052) with the control group. This equated to a moderate effect size of 0.506 (95% CI 0.344 to 0.668) using a random-effects model. Statistical heterogeneity was high ($I^2=88.2$%). Participants aged 65 and over showed a significantly greater effect of diabetes self-management education on reducing A1C (effect size 0.725, 95% CI 0.161 to 1.290) compared to adults under 65 years (effect size 0.380, 95% CI 0.214 to 0.546) and children and adolescents (effect size 0.418, 95% CI 0.086 to 0.750). The effect of diabetes self-management education on glycaemic control was greatest in studies with follow-up of one to six months (effect size 0.779, 95% CI 0.245 to 1.312) compared to studies with follow-up periods of seven to 12 months (effect size 0.332, 95% CI 0.175 to 0.489) and over 12 months (effect size 0.526, 95% CI 0.289 to 0.764).

Type of diabetes, baseline A1C 8.0% or less and country of study were not significantly associated with the impact of diabetes self-management education on change in A1C. Studies with a reduced proportion of females showed an increased effect size for lowering A1C.

**Impact of diabetes self-management education on cardiovascular factors**

Diabetes self-management education had a significant effect on reduction of diastolic blood pressure (effect size 0.805, 95% CI 0.314 to 1.295), reduction in total cholesterol (effect size 0.639, 95% CI 0.153 to 1.125), increase in HDL (effect size 0.655, 95% CI 0.114 to 1.195) and decrease in LDL (effect size 0.237, 95% CI 0.044 to 0.431) but the net changes in these outcomes were non-significant.

The impact of diabetes self-management programmes on triglycerides, systolic blood pressure and body weight were non-significant for both net changes and effect sizes. There was evidence of significant statistical heterogeneity for diastolic blood pressure ($I^2=96.8$%), HDL ($I^2=95.4$%), LDL ($I^2=71.9$%) and total cholesterol ($I^2=96.1$%). Baseline A1C 8.0% or less and proportion of females (45% to 55%, >65%) was significantly associated with a different effect of diabetes self-management education on diastolic blood pressure, systolic blood pressure and HDL. Studies conducted in USA were associated with a significantly greater effect of diabetes self-management programmes on HDL and total cholesterol.

**Authors’ conclusions**

Nurse-led diabetes self-management programmes were associated with improved glycaemic control, particularly in participants over 65 years and for follow-up periods of one to six months.

**CRD commentary**

The review addressed a clear question with well-defined inclusion criteria. Only two databases were searched so relevant studies may have been missed. The search was restricted to published articles and publication bias was not assessed so publication bias could not be ruled out. It was unclear whether the search was restricted by language so it was difficult to assess the risk of language bias. Data extraction and study selection were carried out by more than one reviewer but it was unclear whether this was performed independently and so reviewer error and bias have affected the results. The quality of included studies was not assessed so it was not possible to rule out potential sources of bias that may have affected the reliability of the results.

Attrition rates were high in some studies which undermined the reliability of the findings. There was no detailed information on individual studies. It appeared that there was clinical heterogeneity between studies. High levels of statistical heterogeneity were reported for some outcomes. It may not have been appropriate to combine the studies in a meta-analysis. Four authors were employees of IMIB (Roche Diagnostics Diabetes Care) and one author was an employee of Roche Diagnostics Diabetes Care.
employee of Roche Diagnostics.

Potential for bias in the review process, uncertainties regarding study quality and high levels of statistical heterogeneity mean that the authors' conclusions should be treated with caution.

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

**Practice:** The authors stated that further nurse-led diabetes self-management education programmes should be developed for the needs of younger populations (under 65 years). These programmes should be adapted to the local culture and local diabetes self-management practices. Nurse-led diabetes self-management programmes were also needed for patients with good glycaemic control and in patient groups other than male patients.

**Research:** The authors did not make any recommendations for further research.

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