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HSR&D

Self-Monitoring of Blood Glucose in Patients with Type 2 Diabetes Mellitus: Meta Analysis of Effectiveness

EXECUTIVE SUMMARY

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BACKGROUND

Diabetes is a prevalent and costly disease in Veterans. Control of blood glucose is an important VA objective. Self-monitoring of blood glucose (SMBG) is advocated as a method to better achieve control.

The Key Questions were:

> Key Question 1. Is regular SMBG effective in achieving target A1c levels for patients with type 2 diabetes?
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> Key Question 2. Is regular SMBG effective in maintaining target A1c levels for patients with type 2 diabetes?
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> Key Question 3. Does regular SMBG reduce the frequency of hypoglycemia in patients with type 2 diabetes?
>
> Key Question 4. Is there evidence that different frequencies of testing result in differences in improvements in A1c?

METHODS

We searched PubMed from 2004-2006 using standard search terms. We performed an update search in July 2007. Titles, abstracts, and articles were reviewed in duplicate by physicians trained in the critical analysis of literature. Data were extracted by quantitative analysts. Pooled analyses were performed for trials with A1c outcomes at six months and 12 months or greater of follow-up. All other data were narratively summarized.

RESULTS

We screened 52 titles, 14 were rejected, and we performed a more detailed review on 38 articles. From this, we identified 14 randomized controlled trials (RCTs) that measured the effect of SMBG compared to a group not receiving SMBG and monitored A1c levels with at least three months of follow-up. Four trials were excluded; one because it presented duplicate data and three because they evaluated SMBG in both the control and intervention groups, leaving 10 trials contributing to the efficacy analysis. We identified five observational studies assessing effectiveness in diabetic Veterans.

KEY QUESTION #1: Is regular SMBG effective in achieving target A1c levels for patients with type 2 diabetes?

STUDIES OF EFFICACY

Achieving Target A1c Levels

There is little evidence to draw a conclusion about the effect of SMBG at achieving target A1c levels. We judged the strength of this evidence as very low. [GRADE: Very Low = Any estimate of effect is very uncertain.]

Improving Glycemic Control
We found that adding SMBG along with education, counseling, (and some times other components) results in a statistically significant decrease in A1c level of an absolute 0.21% at six months. Results at three months and one year are more variable, although there is a suggestion that this benefit may continue out to at least one year.

We judged the strength of evidence for this outcome as moderate, because individual trials did not in general report significant results and interventions were heterogeneous. [GRADE: Moderate= Further research is likely to have an important impact on our confidence in the estimate of effect and may change the estimate.]

STUDIES OF EFFECTIVENESS IN VETERANS
Five observational studies of SMBG effectiveness in Veteran populations did not report statistically significant improvements in glycemic control. [GRADE: Very Low = Any estimate of effect is very uncertain.]

KEY QUESTION #2: Is regular SMBG effective in maintaining target A1c levels for patients with type 2 diabetes?
We did not identify any trials that directly assessed this question. Therefore, we draw no conclusion and the strength of evidence is very low. [GRADE: Very Low = Any estimate of effect is very uncertain.]

KEY QUESTION #3: Does regular SMBG reduce the frequency of hypoglycemia in patients with type 2 diabetes?
The limited evidence available indicates that SMBG increases the frequency of recognized hypoglycemia. This is due to an increase in asymptomatic low blood sugar readings, and also an increase in mild-to-moderate symptomatic episodes. There is scant evidence about the effect of SMBG on more clinically significant hypoglycemia. We judge the strength of evidence for SMBG increasing asymptomatic and mildly symptomatic hypoglycemia as moderate. [Moderate = Further research is likely to have an important impact on our confidence in the estimate of effect and may change the estimate.]

KEY QUESTION #4: Is there evidence that different frequencies of testing result in differences in improvements in A1c?
We used meta-regression to assess the effect of the reported frequency of SMBG use in the RCTs (measures as times/week) on differences in A1c level compared to control. No association was found ($p=0.99$). Therefore we draw no conclusion about the effect of frequency of SMBG monitoring on A1c values, and judge the strength of the evidence to be very low. [GRADE: Very Low = Any estimate of effect is very uncertain.]