Cost effectiveness of self monitoring of blood glucose in patients with non-insulin treated type 2 diabetes: economic evaluation of data from the DiGEM trial

Judit Simon, Alastair Gray, Philip Clarke, Alisha Wade, Andrew Neil, Andrew Farmer and on behalf of the Diabetes Glycaemic Education and Monitoring Trial Group

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Cost effectiveness of self monitoring of blood glucose in patients with non-insulin treated type 2 diabetes: economic evaluation of data from the DiGEM trial

Judit Simon,1 Alastair Gray,1 Philip Clarke,2 Alisha Wade,3 Andrew Neil,4 Andrew Farmer,5 on behalf of the Diabetes Glycaemic Education and Monitoring Trial Group

ABSTRACT

Objective To assess the cost effectiveness of self monitoring of blood glucose alone or with additional training in incorporating the results into self care, in addition to standardised usual care for patients with non-insulin treated type 2 diabetes.

Design Incremental cost utility analysis from a healthcare perspective. Data on resource use from the randomised controlled diabetes glycaemic education and monitoring (DiGEM) trial covered 12 months before baseline and 12 months of trial follow-up. Quality of life was measured at baseline and 12 months using the EuroQol EQ-5D questionnaire.

Setting Primary care in the United Kingdom.

Participants 453 patients with non-insulin treated type 2 diabetes.

Interventions Standardised usual care (control) compared with additional self monitoring of blood glucose alone (less intensive self monitoring) or with training in self interpretation of the results (more intensive self monitoring).

Main outcome measures Quality adjusted life years and healthcare costs (sterling in 2005-6 prices).

Results The average costs of intervention were £89 (€113; £173) for more intensive self monitoring, showing an additional cost per patient of £92 (95% confidence interval £80 to £103) in the less intensive group and £84 (€73 to €96) in the more intensive group. No other significant cost difference was detected between the groups. An initial negative impact of self monitoring on quality of life occurred, averaging −0.027 (95% confidence interval −0.069 to 0.015) for the less intensive self monitoring group and −0.075 (−0.119 to −0.031) for the more intensive group.

Conclusions Self monitoring of blood glucose with or without additional training in incorporating the results into self care was associated with higher costs and lower quality of life in patients with non-insulin treated type 2 diabetes. In light of this, and no clinically significant differences in other outcomes, self monitoring of blood glucose is unlikely to be cost effective in addition to standardised usual care.

Trial registration Current Controlled Trials ISRCTN47464659.

INTRODUCTION

Self monitoring of blood glucose has been shown to be the largest single component of management costs associated with implementing more intensive glycaemic control in the UK.1 Improvements in haemoglobin A1c levels are associated with reduced rates of long term complications from diabetes. Although these improvements may lead to gains in quality adjusted life expectancy and generate savings within the healthcare system, self monitoring has opportunity costs as funds could be used to finance other aspects of managing non-insulin treated type 2 diabetes. We carried out an economic evaluation of self monitoring of blood glucose using data from the diabetes glycaemic education and monitoring (DiGEM) trial.2

METHODS

The diabetes glycaemic education and monitoring trial was an open, randomised study of 453 patients with non-insulin treated type 2 diabetes who had haemoglobin A1c levels of 6.2% or more and were self monitoring not more than once a week.2 These patients were allocated to either standardised usual care (control, n=152), a blood glucose meter with advice for participants to contact their doctor for...
These data were collected from patients’ diaries, nurses’ notes, and comorbidity. We imputed missing data on randomisation group, age, sex, duration of diabetes, costs for intervention were statistically significant: £89 (95% confidence interval £60 to £119) in the less intensive group and £5 (95% confidence interval £2 to £10) in the more intensive group. Differences in costs were found between the control groups in the overall cost of diabetes drugs (see bmj.com). A non-significant increase occurred in other healthcare costs between the period before baseline and follow-up, averaging about £100-£150 per patient in each group, which was mainly attributable to additional admissions to hospital (see bmj.com). During the 12 months before baseline the total mean healthcare costs per patient averaged £1042 for standardised usual care, £1048 for less intensive self monitoring, and £1145 for more intensive self monitoring. The costs increased by about £500-£400 over the trial period to £1371, £1434, and £1482. No statistically significant differences were found between the groups.

Effects
The control group showed no significant change in mean utility per patient during the trial. By contrast, patients in both self monitoring groups showed reductions in quality of life, which reached statistical
WHAT IS ALREADY KNOWN ON THIS TOPIC

The clinical effects of blood glucose testing in non-insulin treated type 2 diabetes are unclear. Self monitoring of blood glucose is costly. A previous study suggesting that routine self monitoring could be cost effective for non-insulin treated diabetes was potentially confounded by heterogeneity.

WHAT THIS STUDY ADDS

Self monitoring in non-insulin treated type 2 diabetes is unlikely to be cost effective and should not be recommended for routine use. The additional intervention costs of self monitoring of blood glucose are between £84 and £92 per patient over 12 months. Self monitoring has an initial negative impact on quality of life, in part associated with increased reported anxiety.

The higher costs of visits to a primary care surgery for the more intensive self monitoring group than for standardised usual care may relate to the observed changes in health status between the groups, with a need to seek further support or advice, or may be a chance finding.

This study is a prospectively designed economic evaluation of information collected on relevant items of healthcare resource use and quality of life in a randomised controlled trial. The base case analysis used the full imputed dataset but we also did available and complete case analyses on costs and effects, respectively. We adjusted the incremental costs and outcomes for baseline variations between the groups and we used sensitivity analysis to assess the effect of uncertainty surrounding some aspects of the costs and effects.

The estimates of costs and effects reported here are averages for the routine recommendation to use self monitoring across reasonably well controlled patients with non-insulin treated type 2 diabetes. These results may not reflect the costs and benefits in other specific groups, or where usual care has not been standardised to recommended levels. Also, although the EuroQol is a widely applied instrument for measuring quality of life, it may not capture all aspects of quality of life changes.

One modelling study using aggregated data from a meta-analysis of randomised trials estimated the cost effectiveness of self monitoring to be between £4500 and £15 515 per QALY gained. The meta-analysis concluded that the level of clinical evidence showing that self monitoring could improve haemoglobin A1c levels was only moderate. Problems with included trials were low rates of follow-up, use of per protocol rather than intention to treat analyses, and co-intervention with both education and self monitoring compared with usual care.

The results of this analysis, and the reported lack of convincing evidence for an impact on haemoglobin A1c levels, indicate that self monitoring (less and more intensive) of blood glucose is unlikely to have significant lifetime health benefits or to be cost effective in addition to standardised usual care. It is possible that subgroups of patients exist for whom self monitoring may be cost effective—patients who adhere closely to treatment and who may have been excluded from the trial.

These results are based on a prospective trial over 12 months. Given this time horizon we may not have captured all relevant costs and effects. Therefore we also did a secondary analysis predicting the lifetime quality adjusted life expectancy and costs of complications from diabetes by extrapolating main risk factors beyond the trial period using modelling techniques (see bmj.com).

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Contributors: See bmj.com.

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Different strategies for screening and prevention of type 2 diabetes in adults: cost effectiveness analysis

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ABSTRACT
Objective To compare four potential screening strategies, and subsequent interventions, for the prevention and treatment of type 2 diabetes: (a) screening for type 2 diabetes to enable early detection and treatment, (b) screening for type 2 diabetes and impaired glucose tolerance, intervening with lifestyle interventions in those with a diagnosis of impaired glucose tolerance to delay or prevent diabetes, (c) as for (b) but with pharmacological interventions, and (d) no screening.

Design Cost effectiveness analysis based on development and evaluation of probabilistic, comprehensive economic decision analytic model, from screening to death.

Setting A hypothetical population, aged 45 at time of screening, with above average risk of diabetes.

Data sources Published clinical trials and epidemiological studies retrieved from electronic bibliographic databases; supplementary data obtained from the Department of Health statistics for England and Wales, the screening those at risk (STAR) study, and the Leicester division of the ADDITION study.

Methods A hybrid decision tree/Markov model was developed to simulate the long term effects of each screening strategy, in terms of both clinical and cost effectiveness outcomes. The base case model assumed a 50 year time horizon with discounting of both costs and benefits at 3.5%. Sensitivity analyses were carried out to investigate assumptions of the model and to identify which model inputs had most impact on the results.

Results Estimated costs for each quality adjusted life year (QALY) gained (discounted at 3.5% a year for both costs and benefits) were £14 150 (£17 560; $27 860) for screening for type 2 diabetes, £6242 for screening for diabetes and impaired glucose tolerance followed by lifestyle interventions, and £7023 for screening for diabetes and impaired glucose tolerance followed by pharmacological interventions, all compared with no screening. At a willingness-to-pay threshold of £20 000 the probability of the intervention being cost effective was 49%, 93%, and 85% for each of the active screening strategies respectively.

Conclusions Screening for type 2 diabetes and impaired glucose tolerance, with appropriate intervention for those with impaired glucose tolerance, in an above average risk population aged 45, seems to be cost effective. The cost effectiveness of a policy of screening for diabetes alone, which offered no intervention to those with impaired glucose tolerance, is still uncertain, and further research on the impact of early detection of diabetes is needed.

INTRODUCTION
Currently there is no systematic screening policy for type 2 diabetes in the United Kingdom. One approach would be to screen only for type 2 diabetes, which will allow for early diagnosis and treatment. An estimated 50% of people with diabetes are currently undiagnosed, and at presentation around 20-30% have developed complications. An alternative approach would be to lower the threshold of the screening test and to screen for impaired glucose tolerance and type 2 diabetes together. As well as allowing for earlier diagnosis of type 2 diabetes, interventions can be administered to those individuals with impaired glucose tolerance to delay the onset of type 2 diabetes. A recent systematic review and meta-analysis of intervention trials for prevention of type 2 diabetes found both lifestyle and pharmacological interventions significantly reduced the risk of type 2 diabetes in people with impaired glucose tolerance.