

Recommendations and conclusions from a mini-symposium on self-blood glucose monitoring

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ABSTRACT It is agreed that all patients with insulin-treated diabetes should regularly self-monitor their blood glucose to guide insulin doses and detect and avoid hypoglycaemia, but there remains little consensus as to the value of SBGM in patients with type 2 diabetes treated with diet and/or tablets. This Royal College of Physicians of Edinburgh mini-symposium brought together a panel of experts to examine the current evidence surrounding SBGM in this context. The aim of this document is to provide an overview of the points raised and where consensus was achieved. The document summarises the general situations where SBGM may or may not be useful, and it is hoped that this will be a platform for production of specific guidelines for healthcare professionals to use to advise a monitoring programme for an individual patient. These recommendations include results of evidence published since November 2004.

KEYWORDS Diabetes, diet-controlled, glucose monitoring, self-monitoring, tablet-controlled.

LIST OF ABBREVIATIONS Diabetes Glycaemic Education and Monitoring Study (DiGEM), International Standard Randomised Controlled Trial Number (ISRCTN), National Institute for Health and Clinical Excellence (NICE), self-blood glucose monitoring (SBGM), UK Prospective Diabetes Study (UKPDS)

DECLARATION OF INTERESTS No conflict of interests declared.

INTRODUCTION

The aim of this Royal College of Physicians of Edinburgh mini-symposium was to examine the evidence regarding SBGM in patients with type 2 diabetes mellitus treated with diet and/or tablets, and then to consider current practice with the aim of producing general recommendations for SBGM within the broader management of diabetes. Although there has been concern regarding the variety of glucose meters available and the high cost of strips, the main object was to assess the value of SBGM, and to produce recommendations for patients with diabetes and the health professionals providing their care, on who might benefit from testing, and the framework within which this might be undertaken. There was no discussion about urine glucose monitoring.

In the UK in 2001, around £90 million was spent on blood glucose testing strips,¹ some 40% more than was spent on oral hypoglycaemic agents.² As a result, healthcare providers have questioned whether SBGM provides good value for money, improves the wellbeing of patients and adds value to the management of diabetes.³

BACKGROUND

Most diabetes healthcare professionals would agree that those with type 1 diabetes or insulin-treated type 2

diabetes should be encouraged to monitor their blood glucose regularly, to guide insulin doses and to detect and avoid hypoglycaemia. However, there is little consensus on SBGM in type 2 diabetes treated by diet and tablets, and there is enormous variation in the use of SBGM according to geography, and to patient and professional preferences.⁴ Healthcare economists stress the importance of appropriate management for these patients because of the growing number of people with diabetes, the majority of whom will be treated by diet and/or oral hypoglycaemic agents (Diabetes UK, 2004, www.diabetes.org.uk).

Good glycaemic control, assessed by 3–6 monthly measurement of HbA1c, is essential to minimise the long-term micro-vascular complications of diabetes.^{5,6} Self-blood glucose monitoring was included in the UKPDS, yet advice varied and the trial did not establish the benefits of monitoring. It was concluded, in an NHS health technology assessment of studies of SBGM in 2000, that many of the studies are poorly designed, lack statistical power, compare different patient groups, and that glucose monitoring may be just one part of a multi-factorial intervention programme.⁷ More recently published, larger randomised controlled trials have indicated SBGM is beneficial in some individuals, though the significance in terms of HbA1c reduction is variable.^{8–10} Such newer studies have been included in more recent systematic reviews.^{11,12} However,

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it has been impossible to draw together 'evidence-based' consensus guidelines from the current published literature. For example, the SIGN guidelines offered no recommendations for SBGM in type 2 diabetes, concluding that there were no studies that had 'adequately assessed the benefits of glucose monitoring in glycaemic control'.¹³ By contrast, the National Diabetes Support Team suggested that SBGM should be part of integrated self-care, highlighting the benefits of SBGM when used appropriately with suitable training.¹⁴ The National Institute for Clinical Excellence also supported SBGM in type 2 diabetes, but did not provide recommendations on the frequency of testing.¹⁵ The ongoing DiGEM trial, may help address some of these issues (ISRCTN 47464659).

Although systematic reviews have failed to show clear benefits from SBGM, professional agencies in Europe and the US continue to view it as an 'essential' component of type 2 diabetes care.¹⁶ In the absence of reliable randomised controlled trials, our current 'best evidence' may need to rely on the 'personal experience' of patients and clinicians. Such consensus advice on SBGM was published recently,¹⁷ suggesting that SBGM was not required routinely and should only be used in special circumstances in type 2 diabetes. This included measuring blood glucose once a day during inter-current illness, when oral hypoglycaemic therapy is changed, when systemic glucocorticoids are prescribed and in patients with post-prandial hyperglycaemia. Self-blood glucose monitoring was also suggested for patients on sulphonylurea therapy because of the risk of hypoglycaemia. None of these recommendations was underpinned by robust evidence. An alternative approach by the UK-based Diabetes Monitoring Forum, offered patients different reasons for testing their blood glucose.¹⁸ Both of these publications^{17,18} were sponsored by the pharmaceutical industry, highlighting the need for independent research to address key questions about the clinical- and cost-effectiveness of SBGM.

As it is accepted that most patients treated with insulin should self-monitor their blood glucose, the principal aim of the symposium was to focus on the controversial area of what advice to give to patients with type 2 diabetes treated with diet or tablets alone, acknowledging that any emerging research will lead to guideline revision.

RECOMMENDATIONS FROM THE MINI-SYMPOSIUM

Type 1 diabetes and insulin therapy in type 2 diabetes

People with type 1 diabetes, or insulin-treated type 2 diabetes, should monitor their blood glucose regularly to guide insulin doses and to detect and avoid hypoglycaemia. In particular, patients should be informed of the increased metabolic demand during driving and of the associated increased risk of hypoglycaemia.¹⁷

- Self-blood glucose monitoring should be seen as an integral part of treating type 1 diabetes and insulin-treated type 2 diabetes.
- Patients should be trained in SBGM and in how to alter treatment appropriately. This may require monitoring of fasting, pre-prandial, pre-bedtime, and, occasionally post-prandial glucose levels, particularly during changes of insulin doses.
- Advice about frequency of testing and target blood glucose values should be individualised and discussed with the local diabetes team.
- The following situations may need more frequent SBGM and should be discussed with the local diabetes team: intercurrent illness, myocardial infarction, dialysis, pregnancy, impaired awareness and/or repeated episodes of hypoglycaemia, physical activity, carbohydrate counting.

Type 2 diabetes treated with diet and exercise and oral hypoglycaemic agents

HbA1c is the main important and agreed outcome measure and should be measured 3–6 monthly²⁰ although this is not currently possible in Scotland. In practice, the level of SBGM that is recommended will vary according to the treatment regimen and the target level of glycaemic control for the individual. Thus, self-monitoring may be unnecessary in individuals with stable control and is not routinely required.

Proponents argue that SBGM empowers people with type 2 diabetes, improving their quality of life by giving them control over their disease and thus reducing anxiety. This may be true if SBGM is part of integrated care including training and education in interpretation of results. Patients who self-monitor may observe the effect that different foods and exercise have on their blood glucose concentrations and this may help promote alterations in diet and physical activity. In addition, self-monitoring may allow for the detection of hypoglycaemia before symptoms of neuroglycopenia develop. Self-blood glucose monitoring may also provide information allowing healthcare professionals to make rational decisions on changing treatment.

On the other hand, there are also reasons why SBGM may not be necessary. Some patients have good and stable control, and SBGM may offer no additional benefit. Indeed, studies suggest only a minimal benefit on glycaemic control⁹ and there is no reliable evidence about the benefit of SBGM in reducing hypoglycaemia.⁷ In addition, some studies have suggested that SBGM adversely affects quality of life by causing higher distress, worry and depressive symptoms.²¹ Other perceived disadvantages include the perception that the procedure is painful, time-consuming and troublesome. Furthermore, data from prescription monitoring suggests many patients elect not to monitor regularly²² and, for a variety of reasons, not all recorded results are accurate or reliable.²³

SUMMARY OF RECOMMENDATIONS

Self-blood glucose monitoring in type 2 diabetes treated with diet, exercise and oral hypoglycaemic agents

- Patients should be reassured that SBGM is not essential when they have stable, well-controlled glucose levels.
- The possible advantages and disadvantages of SBGM should be explained to allow patients to make an informed choice on SBGM in the management of their diabetes.
- Patients using SBGM should be educated in interpretation of the results and how to make appropriate amendments to treatment and/or lifestyle.
- The frequency and timing of SBGM should be tailored for the individual and could vary from one test each week to 2–3 tests at different times of day.

A profile of SBGM results up to 2–3 times per week at different times of day may be more helpful than one test per day, particularly if therapy is changing.

- The value of SBGM as an adjunct to therapy should be reviewed regularly. Discussion should include the timing, frequency and results of testing, and advice will change depending on overall control and stage of diabetes.
- During intercurrent illness, when therapy is changed or if glucocorticoids are co-prescribed, patients may benefit from SBGM, and frequency of testing and targets should be individualised.
- Patients treated with sulphonylureas are at risk of hypoglycaemia, but an accurate history from the patient or relative may be at least as useful as SBGM in the detection of hypoglycaemia. Self-blood glucose monitoring may then be used to confirm low blood glucose levels in patients with suspected hypoglycaemia.

REFERENCES

- 1 National Prescribing Centre. When and how should patients with diabetes mellitus test blood glucose? *MeReC Bulletin* 2002; **13**:1–4.
- 2 Tiley S. Home blood glucose monitoring – what cost? *Practical Diabetes International* 2002; **19**:S1–S4.
- 3 Reynolds RM, Strachan MW. Home blood glucose monitoring in type 2 diabetes. *BMJ* 2004; **329**:754–5.
- 4 Gulliford DE, Latinovic R. Variations in glucose self-monitoring during oral hypoglycaemic therapy in primary care. *Diabetic Medicine* 2004; **21**:685–90.
- 5 Department of Health National Service Framework for Diabetes: Standards. London: Department of Health; 2001.
- 6 UK Prospective Diabetes Study (UKPDS) group. Intensive blood glucose control with sulphonylureas or insulin compared with conventional treatment and risk of complications in patients with type 2 diabetes (UKPDS 33). *Lancet* 1998; **352**:837–53.
- 7 Coster S, Gulliford MC, Seed PT *et al.* Monitoring blood glucose control in diabetes mellitus: a systematic review. *Health Technol Assess* 2000; **4**:i–iv, 1–93.
- 8 Schwedes U, Siebolds M, Mertes G. Meal-related structured self-monitoring of blood glucose. *Diabetes Care* 2002; **25**:1928–32.
- 9 Guerci B, Drouin P, Grangé V *et al.* Self-monitoring of blood glucose significantly improves metabolic control in patients with type 2 diabetes mellitus: the Auto-Surveillance Intervention Active (ASIA) study. *Diabetes Metab* 2003; **29**:587–94.
- 10 Martin S. German Diabetes Centre, Leibniz-Institute at the Heinrich-Heine-University, Dusseldorf. American Diabetes Association Abstract. June 2005.
- 11 Berganstal RM, Gavin III JR on behalf of the Global Consensus on Glucose Monitoring Panel. The role of self-monitoring of blood glucose in the care of people with diabetes: report of a global consensus conference. *Am J Med* 2005; **118** (9A):1S–6S.
- 12 Welschen LMC, Bloemendal E, Nijpels G *et al.* Self-monitoring of blood glucose in patients with type 2 diabetes who are not using insulin. A systematic review. *Diabetes Care* 2005; **28**(6):1510–7.
- 13 Scottish Intercollegiate Guidelines Network. *Management of diabetes*. Edinburgh: SIGN; 2001. www.sign.ac.uk/guidelines/fulltext/55/index.html
- 14 National Diabetes Support Team. *Glucose self-monitoring in diabetes: fact sheet no.1*. NHS Modernisation Agency Clinical Governance Support Team; 2003.
- 15 National Institute for Clinical Excellence. *Management of type 2 diabetes: management of blood glucose*. London: NICE; 2002. www.nice.org.uk/pdf/NICE_INHERITEG_guidelines.pdf.
- 16 Goldstein DE, Little RR, Lorenz RA *et al.* Tests of glycemia in diabetes. *Diabetes Care* 2004; **27**:1761–73.
- 17 Owens D, Barnett AH, Pickup J *et al.* Blood glucose self-monitoring in type 1 and type 2 diabetes: reaching a multidisciplinary consensus. *Diabetes and Primary Care* 2004; **6**:8–16.
- 18 Diabetes Monitoring Forum. Reasons for testing your blood glucose. 2004; www.dmforum.org.uk
- 19 Cox DJ, Gonder-Frederick LA, Kovatchev BP *et al.* Progressive hypoglycemia's impact on driving simulation performance. Occurrence, awareness and correction. *Diabetes Care* 2000; **23**: 163–70.
- 20 UK Prospective Diabetes Study (UKPDS). Intensive blood-glucose control with sulphonylureas or insulin compared with conventional treatment and risk of complications in patients with type 2 diabetes (UKPDS33). *Lancet* 1998; **352**:837–53.
- 21 Franciosi M, Pellegrini F, De Beradis G *et al.* Impact of blood glucose monitoring on metabolic control and quality of life in type 2 diabetic patients. *Diabetes Care* 2001; **24**:1870–7.
- 22 Evans JMM, Newton RW, Ruta DA *et al.* Frequency of blood glucose monitoring in relation to glycaemic control: observational study with diabetes database. *BMJ* 1999; **319**:83–6.
- 23 Williams CD, Scobie IN, Till S *et al.* Use of memory meters to measure reliability of self-blood glucose monitoring. *Diabetic Medicine* 1988; **5**:459–62.

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Supported by an educational grant from Pfizer, UK.