

Management of type 1 diabetes

How can continuous glucose monitoring technology improve the lives of people with diabetes?



Adrian Scott,
Consultant Physician
in Diabetes and
General Medicine,
Northern General
Hospital, Sheffield

However you look at it, the management of insulin-treated diabetes seems ridiculous. At best, the obsessive compulsive is expected to measure capillary blood glucose with a fingerprick test, preferably before meals, bedtime and (on special occasions) at 3 am. If

pregnant, a person with diabetes is expected to make similar measurements an hour and a half after meals. Armed with this essential information, the next step is to calculate the exact carbohydrate content of the meal (all three, or will it be four courses?) to the nearest 5 g, divide it by 10 and multiply by their personal carbohydrate:insulin ratio. Hey presto! The dose of rapid-acting insulin can now be administered with the hope that nobody knocks on the door just as they sit down to eat.

In the event of a miscalculation, a missed meal, overenthusiastic physical activity or the wrong phase of the moon, another fingerprick test is encouraged to confirm that the blood

glucose level really is below 4 mmol/L before administering that well-known hypoglycaemia cure: five jelly babies (the perfect way to finish off a meal at Le Manoir aux Quat Saisons).

Maybe in my lifetime, closed-loop glucose sensing and insulin delivery systems will be widely available for people with diabetes needing insulin (perhaps that is a little fanciful since most people with type 1 diabetes in Africa cannot even get reliable supplies of insulin). Certainly the continuous glucose monitoring arm of the loop is becoming a reality with the production of the SEVEN® (DexCom, San Diego, California) and Navigator® (Abbott Diabetes Care, Alameda, California) continuous glucose monitors.

The paper summarised alongside illustrates their accuracy in comparison with laboratory-measured venous samples. The technology is awesome and each sensor may give continuous glucose measurements for up to 5 days. The benefits are huge. Being able to have an extra portion of Raymond Blanc's apricot and passion fruit soufflé instead of jelly babies is the most compelling.

DIABETES TECHNOLOGY & THERAPEUTICS

Accuracy of SEVEN and Navigator CGM systems is comparable

Readability	✓✓
Applicability to practice	✓✓✓✓
WOW! factor	✓✓✓✓

1 The accuracy and safety of two continuous glucose monitoring (CGM) systems were evaluated, by comparing the readings with the YSI laboratory measurements of blood glucose.

2 The CGM systems that were evaluated were the SEVEN® (DexCom, San Diego, California) and the Navigator® (Abbott Diabetes Care, Alameda, California).

3 A total of 14 participants with type 1 diabetes wore either the SEVEN® or the Navigator® blood glucose meter while concurrently wearing the YSI blood glucose meter (YSI, Yellow Springs, Ohio). The blood glucose monitors were worn for three consecutive 5-day sessions.

4 Participants attended an 8-hour in-clinic session once every 5 days, where readings from the CGM devices were noted every 15 minutes and compared with YSI measurements. The sensors were replaced at the end of each session.

5 The mean absolute relative difference (ARD) for the two CGM devices versus YSI was not different (16.8% for SEVEN; 16.1% for Navigator [$P=0.38$]).

6 The ARD in the hypoglycaemic region (YSI value <80 mg/dL) was lower for SEVEN (21.5%) than for Navigator (29.8%; $P=0.001$).

7 Glucose measurements were similar in both of the CGM devices, except that the SEVEN performed better in the hypoglycaemic range.

Garg SK, Smith J, Beatson C et al (2009) Comparison of accuracy and safety of the SEVEN and the Navigator continuous glucose monitoring systems. *Diabetes Technol Ther* 11: 65–72

DIABETES TECHNOLOGY & THERAPEUTICS

Diabetes Interactive Diary software helps to calculate insulin doses

Readability	✓✓✓✓
Applicability to practice	✓✓✓✓
WOW! factor	✓✓✓

1 The Diabetes Interactive Diary (DID) was created to facilitate carbohydrate counting and dose calculation for people with type 1 diabetes. The software allows the recording of blood glucose values and the calculation of the carbohydrate content of a meal by using pictures.

2 Data were sent to the physician by text message. The software was downloaded on to the mobile phones

of 50 participants who responded to a questionnaire.

3 Almost all participants found the software easy to use and very helpful.

4 A further 41 participants used the DID software and were followed-up for a median of 9 months.

5 A non-statistically significant reduction in fasting blood glucose, postprandial blood glucose and HbA_{1c} was associated with the use of DID software.

6 There were no reported serious episodes of hypoglycaemia during the study period.

7 DID is a useful, safe and easy-to-use tool to help people with type 1 diabetes to administer the correct insulin dose, whatever they eat.

Rossi MC, Nicolucci A, Pellegrini F et al (2009) Interactive diary for diabetes: A useful and easy-to-use new telemedicine system to support the decision-making process in type 1 diabetes. *Diabetes Technol Ther* 11: 19–24

“Based on the number of prescriptions for diabetes treatments, the prevalence of both type 1 and type 2 diabetes has significantly increased in children and adolescents in the UK.”

DIABETES RESEARCH AND CLINICAL PRACTICE

Telemedicine did not improve HbA_{1c} in people with T1D

Readability	✓✓✓✓
Applicability to practice	✓✓✓✓
WOW! factor	✓✓✓✓

1 This article reviewed the evidence for the use of web-based systems as an aid to the intensification of treatment for people with type 1 diabetes.

2 Studies included in the review were published randomised controlled trials or observational studies where the intervention was a web-based upload of blood glucose and other useful data (such as diet and physical activity).

3 The primary outcome was to see whether or not these interventions improved HbA_{1c}.

4 Eight studies focused on participants with type 1 diabetes, and the intervention involved uploading blood glucose data to a website, and feedback from a clinician every 2 weeks, by telephone, or text message.

5 Most participants had inadequate glycaemic control when they enrolled with an HbA_{1c} of >8% and in some studies, >9%.

6 Both the intervention and control groups experienced significant improvements in HbA_{1c} at the end of the intervention, but there was no significant difference between the groups. This may be due to the positive effect of just enrolling in the study.

7 This review concluded that, in people with type 1 diabetes, more intervention is required to improve HbA_{1c} than was provided in these studies.

Azar M, Gabbay R (2009) Web-based management of diabetes through glucose uploads: has the time come for telemedicine? *Diabetes Res Clin Pract* **83**: 9–17

BRITISH JOURNAL OF CLINICAL PHARMACOLOGY

Prevalence of diabetes in children is increasing

Readability	✓✓✓✓
Applicability to practice	✓✓✓✓
WOW! factor	✓✓✓

1 This study aimed to document the prevalence of diabetes among children and adolescents in the UK based on the number of prescriptions for antidiabetic medications.

2 Data were collected retrospectively from a UK general practice database (IMS Disease Analyzer) for all children aged 0–18 years who received at least

one prescription for antidiabetic drugs from January 1998 to December 2005.

3 Out of 505 754 children, 37 225 prescriptions were issued.

4 Insulin use increased significantly from 1.08 per 1000 children in 1998 to 1.98 in 2005 ($P < 0.001$).

5 There was a significant rise in the use of oral antidiabetic drugs from 0.006 per 1000 children in 1998 to 0.05 in 2005 ($P < 0.001$).

6 Based on the number of prescriptions for diabetes treatments, the prevalence of both type 1 and type 2 diabetes has significantly increased in children and adolescents in the UK.

Hsia Y, Neubert AC, Rani F et al (2009) An increase in the prevalence of type 1 and 2 diabetes in children and adolescents: results from prescription data from a UK general practice database. *Br J Clin Pharmacol* **67**: 242–9

INTERNATIONAL JOURNAL OF CLINICAL PRACTICE

More glycaemic excursions with CSII than with MDI

Readability	✓✓✓
Applicability to practice	✓✓✓✓
WOW! factor	✓✓✓✓

1 Sixteen people with type 1 diabetes and an HbA_{1c} <7% were treated with either CSII (8) or MDI (8). All participants

wore a continuous glucose monitor for 3 days to compare the glycaemic excursions of the two treatments.

2 Participants treated with MDI experienced fewer episodes of hyperglycaemia ($P = 0.075$) and fewer episodes of hypoglycaemia ($P = 0.037$) than those using CSII.

3 Fewer glycaemic excursions were experienced with MDI treatment than CSII.

Simon B, Treat V, Marco C et al (2008) A comparison of glycaemic variability in CSII vs. MDI treated type 1 diabetic patients using CGMS. *Int J Clin Pract* **62**: 1858–63

CHRONIC ILLNESS

Hypoglycaemia symptoms adversely affect quality of life

Readability	✓✓✓
Applicability to practice	✓✓✓
WOW! factor	✓

1 Health-related quality of life (HRQoL) in people with cystic fibrosis and diabetes ($n = 52$), was compared with people with type 1 diabetes ($n = 60$).

2 Participants responded to a questionnaire assessing symptoms suggestive of hypoglycaemia and

HRQoL and recorded blood glucose levels in a diary.

3 In people with cystic fibrosis, diabetes had less of an impact on HRQoL than in people with type 1 diabetes.

4 Symptoms suggestive of hypoglycaemia were less of a problem for those with cystic fibrosis and diabetes, and people with type 1 diabetes had more neuroglycopenic symptoms.

5 Symptoms of hypoglycaemia seem to have an adverse effect on quality of life.

Tierney S, Webb K, Jones A et al (2008) Living with cystic fibrosis-related diabetes or type 1 diabetes mellitus: a comparative study exploring health-related quality of life and patients' reported experiences of hypoglycaemia. *Chronic Illn* **4**: 278–88