

## Technology



### Professional continuous glucose monitoring: Does it improve glycaemic control?

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Enthusiasts advocate the use of retrospective or professional continuous glucose monitoring (PCGM) for its educational value, as it allows the user to see the effects of a variety of different factors, such as insulin delivery, exercise, diet, alcohol, stress and illness, on glucose excursions. As an alternative to real-time CGM, which has been shown to be of benefit in improving control only when used almost continuously (JDRF GCM Study Group, 2008), PCGM is a lot cheaper, and so its value could be extended to a much greater number of patients. However, evidence for the benefit of PCGM is lacking and, increasingly, this is considered an obstacle to funding its use.

The study by Patrascioiu et al from Barcelona, Spain (summarised alongside) is thus a timely contribution to the literature on PCGM. Interestingly, the authors note that PCGM is the only form of CGM that is reimbursed in Spain, despite the paucity of evidence for its benefit. They describe the short- and medium-term glycaemic control outcomes in 67 patients with type 1 diabetes who underwent PCGM using the iPro™ 2 (Medtronic, Northridge, CA, USA), which provides 6 days of sensor data. In order to determine which aspect of glycaemic control would be most appropriate to analyse, the patients were characterised as predominantly having either hyperglycaemic ( $n=43$ ) or hypoglycaemic ( $n=24$ ) problems.

The education that the patients received following PCGM, and the therapeutic adjustments that were made, were found to have a significant short-term effect on glycaemic control. There was a significant decline in HbA<sub>1c</sub> levels from 68.9 mmol/mol (8.45%) to 64.4 mmol/mol (8.04%) at 3–5 months in the hyperglycaemic group, but at 12 months this improvement was no longer significant, with a mean HbA<sub>1c</sub> level of 66.1 mmol/mol (8.20%). In keeping with other interventions to improve glycaemic control, the

higher the initial HbA<sub>1c</sub> the greater the reduction after use of PCGM, although again there was no significant reduction at 12 months. The authors categorised the therapeutic intervention as intensive (change in both basal and bolus insulin delivery) or non-intensive (any other or no change), and observed a greater reduction in HbA<sub>1c</sub> in the intensive treatment group, with a mean between-groups difference in post-intervention HbA<sub>1c</sub> of 4 mmol/mol (0.36%), although the difference was non-significant.

The hypoglycaemic group started with a lower mean HbA<sub>1c</sub> of 57.4 mmol/mol (7.40%), which did not change; however, there was a reduction in the frequency of self-reported mild hypoglycaemic episodes in 86% of the patients in this group at 3–5 months.

It is encouraging for those of us who use PCGM and find it to be a valuable educational tool that this study has confirmed its potential benefit in achieving better glycaemic control. The lack of such evidence from previous reports may reflect the fact that prior generations of PCGM provided only 3 days of sensor information. The imminent availability of Abbott's FreeStyle Libre, which will provide 14 days of retrospective data from one sensor and will not require calibration, raises the prospect of obtaining even more valuable information from a single period of PCGM, and hence achieving even greater benefit from this intervention.

The challenge, as with other one-off interventions such as structured education, is sustaining the improvements over time. At least with PCGM it may be that repeating the intervention at 6-monthly intervals will prove to be a cost-effective way of maintaining reductions in HbA<sub>1c</sub> or hypoglycaemia.

Juvenile Diabetes Research Foundation Continuous Glucose Monitoring (JDRF GCM) Study Group (2008) Continuous glucose monitoring and intensive treatment of type 1 diabetes. *N Engl J Med* **359**: 1464–76

### Diabetes Technol Ther

#### Short-term effects of PCGM on glycaemic control in T1D

Readability ////

Applicability to practice ////

WOW! Factor ////

**1** This retrospective study was performed to determine the effect of professional continuous glucose monitoring (PCGM) in patients with poorly controlled T1D.

**2** A total of 67 patients were enrolled and categorised as having problems with either hyperglycaemia ( $n=43$ ) or hypoglycaemia ( $n=24$ ).

**3** Following 6 days of PCGM, the patients consulted with their clinician and were advised on appropriate therapeutic adjustments according to conventional clinical practice. They also received dietary counselling and regular follow-up.

**4** In the hyperglycaemia group, HbA<sub>1c</sub> fell from 68.9 mmol/mol (8.45%) to 64.4 mmol/mol (8.04%) 3–5 months following intervention ( $P=0.001$ ); however, after 1 year, the difference from baseline was no longer significant.

**5** The short-term improvement in glycaemic control was positively correlated with HbA<sub>1c</sub> values at baseline, suggesting that patients with worse glycaemic control may benefit more from PCGM.

**6** In the hypoglycaemia group, there was no significant change in HbA<sub>1c</sub> after 3–5 months or 1 year, but an improvement in the frequency of self-reported hypoglycaemic events occurred in 86% of participants at 3–5 months.

**7** The authors conclude that PCGM can improve glycaemic control, although only on a short-term (3–5-month) basis, in people with poorly controlled T1D.

Patrascioiu I, Quirós C, Ríos P et al (2014) Transitory beneficial effects of professional continuous glucose monitoring on the metabolic control of patients with type 1 diabetes. *Diabetes Technol Ther* **16**: 219–23

## Acta Diabetol

### Internet-based blood glucose monitoring and treatment adjustment in T1D

Readability ✓✓✓  
 Applicability to practice ✓✓✓✓  
 WOW! Factor ✓✓✓✓

**1** Carelink® (Medtronic, Minneapolis, MN, USA) is an online monitoring system to which people with diabetes can upload data on blood glucose levels, food intake and insulin doses, according to which their clinicians can alter their therapy.

**2** The authors assessed the impact of Carelink on glycaemic control in 70 young adults and adolescents (mean age, 14 years) with T1D.

**3** For the first 4 months of the study, participants were randomised to use the Carelink system, including healthcare team-initiated support, or standard care; in the second 4 months, all participants used Carelink but without clinic-initiated contact.

**4** At 4 months, only compliant participants in the intervention group (those who submitted three or more reports in the 4 months; 20 of 36 participants) had significantly lower HbA<sub>1c</sub> compared with baseline (mean reduction, 3.7 mmol/mol [0.34%]; *P*=0.006).

**5** At 8 months, not including participants who were lost to follow-up, the compliance rate fell to seven of 26 people in the intervention group and five of 28 in the control group; only compliant participants in the control group had significant reductions in HbA<sub>1c</sub> compared with baseline.

**6** Use of the Carelink system appears to benefit glycaemic control only in those who are willing to comply. The challenge remains one of motivation, particularly with adolescents.

Shalitin S, Ben-Ari T, Yackobovitch-Gavan M et al (2014) Using the Internet-based upload blood glucose monitoring and therapy management system in patients with type 1 diabetes. *Acta Diabetol* **51**: 247–56

## Diabetologia

### Insulin pump use in T1D and pregnancy

Readability ✓✓✓✓  
 Applicability to practice ✓✓✓✓  
 WOW! Factor ✓✓✓✓

**1** The authors compared the use of insulin pumps and multiple daily injections (MDI) in terms of glycaemic control and maternal and fetal outcomes in 387 pregnant women with T2D.

**2** HbA<sub>1c</sub> improved in both groups over the course of the study; however, the insulin pump group had

a significantly greater improvement compared with the MDI group.

**3** After adjustment for maternal age, diabetes duration and preconception care, insulin pump use was significantly associated with lower mean HbA<sub>1c</sub> in each trimester.

**4** The rates of primary caesarian births, pregnancy loss before 20 weeks' gestation and other adverse maternal outcomes (e.g. severe hypoglycaemia, diabetic ketoacidosis or hypertension) were similar between the two groups.

Kallas-Koeman MM, Kong JM, Klinke JA et al (2014) Insulin pump use in pregnancy is associated with lower HbA<sub>1c</sub> without increasing the rate of severe hypoglycaemia or diabetic ketoacidosis in women with type 1 diabetes. *Diabetologia* **57**: 681–9

## Diabetes Technol Ther

### Protecting against exercise-induced hypoglycaemia with an artificial pancreas

Readability ✓✓✓✓  
 Applicability to practice ✓✓✓✓  
 WOW! Factor ✓✓✓

**1** The authors incorporated heart rate measurement in a control-to-range artificial pancreas system in an attempt to reduce the risk of exercise-induced hypoglycaemia.

**2** The heart rate algorithm detected increases in heart rate ≥125% of the

resting rate, whereupon the basal insulin dose was reduced to account for the risk of hyperglycaemia.

**3** In a randomised crossover design, 12 people with T1D used the artificial pancreas, either with or without the heart rate algorithm, for 26 hours, including a 30-minute exercise period.

**4** When the heart rate algorithm was employed, blood glucose levels declined less during exercise, and the risk of hypoglycaemia was reduced, but not at the expense of glycaemic control.

**5** These encouraging results require confirmation in larger patient cohorts and with different exercise levels.

Breton MD, Brown SA, Karvetski CH et al (2014) Adding heart rate signal to a control-to-range artificial pancreas system improves the protection against hypoglycemia during exercise in type 1 diabetes. *Diabetes Technol Ther* **16**: 506–11

## Diabetes Technol Ther

### Insulin pump adverse events in children and adolescents

Readability ✓✓✓✓  
 Applicability to practice ✓✓✓✓  
 WOW! Factor ✓✓✓

**1** Adverse events (AEs) associated with insulin pumps were investigated in 405 children or adolescents with T1D.

**2** Over a 16-week study period, 50 AEs occurred in 45 participants (11.1%).

**3** The AEs were a result of user- or education-related issues in 44% of cases, and resulted in pump replacement in 38%, hospitalisation or accident and emergency admission in 32%, and permanent pump discontinuation in 4%.

**4** AEs were associated with age <10 years (odds ratio, 3.2) but not gender, HbA<sub>1c</sub>, or diabetes duration.

**5** AEs are still common in modern-generation insulin pumps, but ongoing support and education may help to reduce the incidence.

Wheeler BJ, Heels K, Donaghue KC et al (2014) Insulin pump-associated adverse events in children and adolescents – a prospective study. *Diabetes Technol Ther* **16**: 558–62

“Professional continuous glucose monitoring can improve glycaemic control, although only on a short-term (3–5-month) basis, in people with poorly controlled type 1 diabetes.”