Diabetic Medicine April 2018

**Diabetes Technology Special Issue**

**Editorial**

**Technology: an increasingly important component in the management of diabetes**

Technology is coming and playing an increasingly important role in the lives of people with diabetes and their health care teams. This issue brings together a number of innovative research and up to date review articles from leading diabetes technology investigators, summarising key advances over the past decade and looking towards a technological future in 2030. Previously, capillary glucose monitoring has been the cornerstone of good diabetes management but it now seems ever more likely that Continuous Glucose Monitoring will supersede finger stick testing in the not too distant future. Technological advances in glucose monitoring have made the promise of automated insulin delivery, also known as artificial pancreas or closed-loop, a potential clinical therapeutic reality.

There have been two recent watershed moments in the adoption of diabetes technology. First, in 2016, the FDA decided to endorse pre-meal insulin dosing based on real-time Continuous Glucose Monitoring data (specifically the Dexcom G5 sensor) thereby reducing the need for additional capillary glucose testing. A second game changer was the introduction of the Freestyle Libre, the first factory calibrated, intermittent glucose monitoring system suitable for widespread clinical use. It is intuitive and user friendly, so that little training is required for the person with diabetes or their health care professional. The popularity of this device, marketed direct to users, was such that demand exceeded supply, shortly after its UK launch. NHS England recommended recently that it should be available on prescription leading to expectations that it will become increasingly available in clinical practice.

Messer at al. review nine studies involving 343 real-time Continuous Glucose Monitoring users, providing insights into the interactions of users and health care teams with CGM (1). Real-time Continuous Glucose Monitoring is described as a “high maintenance companion”, an unrelenting continual reminder of diabetes, with some concern that ambivalence from health care teams means that not everyone is offered access. Lack of time, support and professional training are major issues. They also comment on a sensor augmented pump therapy study, which noted that while pump therapy helps with “feeling normal”, it is real-time Continuous Glucose Monitoring that directly impacts on insulin dosing decisions and day-to-day glucose control.

Prahalad et al remind us that rather than shifting the focus towards greater emphasis on data downloads and technology, diabetes technology can help facilitate person-centred care (2). They outline key patient reported outcomes, including depression, diabetes distress, eating and weight issues, all of which impact on diabetes self-management and health outcomes. The potential for technology, telemedicine and digital health interventions to reduce diabetes complications and improve health outcomes is succinctly summarised.

The review of real-time Continuous Glucose Monitoring before and during type 1 diabetes pregnancy provides definitive proof of clinical effectiveness in terms of neonatal health outcomes (3). The data described by Feig and Murphy are generalizable across 33 international clinical sites and applicable to women using multiple daily injections and insulin pump therapy. Infants of mothers using real-time Continuous Glucose Monitoring had reduced odds of neonatal complications including large for gestational age, neonatal hypoglycaemia, neonatal intensive care unit admission, and a shorter length of hospital stay.

Another qualitative review focuses on the user experiences of children, adults and pregnant women using real-time Continuous Glucose Monitoring in conjunction with hybrid closed-loop systems (4). Farrington discusses the sociological and psychological aspects of automated insulin delivery, suggesting that while user experiences are mostly favourable with “time-off” from the demands of diabetes, this is somewhat counterbalanced with issues of trust and technical glitches. Experienced users learn to tolerate system inaccuracies and accept that absolute precision is less essential than the overall bigger picture.

Peters and Haidar provide a comprehensive overview of single (insulin-only) and dual-hormone (insulin and glucagon) systems (5). The rationale for dual-hormone therapy is clear and appealing. We can all agree that prevention of hypoglycaemia would be more effective with the administration of glucagon than with the suspension of insulin alone. They conclude that single hormone systems are sufficient for maintenance of overnight glucose control and for preventing late onset post-exercise hypoglycaemia, but there is a potential for further benefits of dual hormone systems on overall hypoglycaemia risk and during exercise.

Thabit and Hovorka bridge the gap between developments in technology and clinical practice (6). They review the role of technology managing diabetes in hospital in-patient settings, with innovative decision support and automated insulin delivery systems having the potential to reduce prescribing errors and improve patient safety without increasing patient or staff burdens.

If real-time Continuous Glucose Monitoring is a “high maintenance companion”, then the Freestyle Libre is its “low maintenance companion”. The early trial data reviewed by Lalantha and Wilmot suggest high user satisfaction and sustained behavioural change with frequent glucose scanning (7). Real-world data provided by the device manufacturer suggest that those who scan the most have the greatest reductions in HbA1c, with data demonstrating that an average user performs a median of 14 scans/day with half of users performing between 10-20 scans a day. The observational studies suggest the potential for striking reductions in HbA1c in children and in adults with poorly controlled diabetes.

Reddy et al describe a small pilot study comparing the role of real-time Continuous Glucose Monitoring (Dexcom G5) and Freestyle Libre on hypoglycaemic outcomes in 40 participants of whom 39 had at least one previous episodes of severe hypoglycaemia (8). Their results suggested that real-time Continuous Glucose Monitoring may be more applicable for those at highest risk of hypoglycaemia.

At present in the UK, the DVLA requires people taking insulin to test their capillary glucose prior to driving and does not recognise interstitial glucose measurements. Rayman et al, however, suggest that Freestyle Libre could support safer diabetes self-management during driving, not by replacing but by prompting more frequent capillary glucose testing (9). Larger studies of longer duration are now indicated in high-risk populations to evaluate the safety of both real-time and intermittent glucose monitoring during driving.

Buch et al review the progress in medical artificial intelligence, where machine algorithms can effectively identify suspicious skin lesions, bolus calculators can improve insulin dosing decisions and technology can help to improve the effectiveness of personalised diabetes therapy and population-based diabetes prevention strategies (10). Kerr et al look to a future “digital diabetes ecosystem” whereby advances in artificial intelligence and machine learning enhance interactions between people with diabetes, health care teams and technology (11). In this utopia, by 2030 diabetes technology will promote optimal self-care behaviours, provide peer support, clinical decision making and deliver value-based health care. At the other end of the spectrum, however, is Stephen Hawking’s suggestion that “AI could end the human race”.

HR Murphy

UK and Republic of Ireland Regional Editor

1Department of Women’s and Children’s Health, Kings College, London

2Norwich Medical School, University of East Anglia

RIG Holt

Editor-in-Chief

University of Southampton

References

1. Messner et al. Best friend or spy: a qualitative meta-synthesis on the impact of continuous glucose monitoring on life with Type 1 diabetes. DME13568
2. Prahalad et al. Diabetes technology: improving care, improving patient-reported outcomes and preventing complications in young people with Type 1 diabetes. DME13588
3. Feig and Murphy. Continuous glucose monitoring in pregnant women with Type 1 diabetes: benefits for mothers, using pumps or pens, and their babies. DME13585
4. Farrington. Psychosocial impacts of hybrid closed-loop systems in the management of diabetes: a review. DME13567
5. Peters and Haidar. Dual-hormone artificial pancreas: benefits and limitations compared with single-hormone systems. DME13581
6. Thabit and Hovorka. Bridging technology and clinical practice: innovating inpatient hyperglycaemia management in non-critical care settings. DME13563
7. Lalantha and Wilmot. Flash Forward: A review of flash glucose monitoring. DME13584
8. Reddy et al. A Randomised Controlled Pilot Study of Continuous Glucose Monitoring and Flash Glucose Monitoring in People with Type 1 Diabetes and Impaired Awareness of Hypoglycaemia. DME13561
9. Rayman et al. Could FreeStyle Libre™ sensor glucose data support decisions for safe driving? DME13515
10. Buch et al. Artificial intelligence in diabetes care. DME13587
11. Kerr et al. Diabetes and technology in 2030: a utopian or dystopian future? DME13586