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Editorial

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Glucose monitoring: Are clinicians using all the data?

"Never think that lack of variability is stability. Don't confuse lack of volatility with stability, ever."

Nassim Nicholas Taleb

The diabetes clinic consultation contains many rituals. Attendees are weighed, have their blood pressure measured, urine is tested and they themselves bring along the results obtained from self-monitoring in anticipation that they are scrutinised by the clinician. Although the pros and cons of self-monitoring of blood glucose levels are subject to on-going debate, a pragmatic view is that, as a minimum, regular testing makes sense for anyone living with diabetes and taking insulin and also for drivers at risk of hypoglycaemia from insulin or a sulphonylurea drug. From the person undertaking self-monitoring and the time, pain and hassle involved, there is an expectation that clinicians will take some interest in the results, but do they?

Historically, self-monitored blood glucose results were presented as a random series of numbers, faithfully recorded in a booklet provided by an insulin or device manufacturer. Apart from illegibility of handwriting, these booklets were often a health hazard covered with blood, as well as foodstuffs, drink and other occasional bodily fluids. From a clinician's perspective, the art of maintaining a good doctor–patient relationship involved making a rapid assessment of the numbers and coming up with a plan (good or bad) as a consequence. An appreciation that some of the numbers were more imagined than real or that no pattern was actually discernible used to be the elephant in the room.

Nowadays, paper logs have given way to electronic diaries with the facility to instantly download multiple blood glucose measurements to be manipulated in time and space. As increasing numbers of people living with type 1 diabetes are using continuous glucose sensors, this is leading to an exponential growth in data to further tax the arithmetical skills of the clinician. However, clear patterns of glucose values are not easily discernible due to marked fluctuations in glucose levels: glucose variability.

There are now almost 40 measures available to assess the quality of glycaemic control, but none has been adopted as a gold standard. Standard deviation is the easiest to understand and the most commonly used metric, but it has limitations (Rodbard, 2011; Dawson et al, 2013). Although the debate around the relationship between glucose variability and risk of diabetes complications continues, there does seem to be a consensus that variability does predict a risk of severe hypoglycaemia (Siegelaar et al, 2010). Manufacturers of blood glucose monitoring equipment do provide a variety of measures of glycaemic variability within their systems, but their use has yet to become mainstream clinical practice, and the value of self-monitored blood glucose values to assess variability is limited by the episodic nature of data collection.

Although still not universally available, the continuous glucose monitoring (CGM) system offers additional insights beyond a single measurement of HbA_{1c}, especially in terms of hypoglycaemia risk. The metrics obtained from CGM system traces are complex and multiple, but there is a need to create a standardised method of reporting sensor data (Bergenstal et al, 2013). With increasing use of CGM devices there is, however, an opportunity to provide more valuable information using composite end points. These could include HbA_{1c} + glucose variability + hypoglycaemia risk; this idea could be developed even further to include markers of cardiovascular risk such as blood pressure and LDL cholesterol.

Clearly, there is a need to move beyond HbA_{1c} as the sole metric for assessment for diabetes care. Hypoglycaemia remains a very important consideration for everyone living with diabetes and using insulin. As such, a measure of this is as important as a measure of HbA_{1c}. As structured blood glucose monitoring becomes the norm and CGM system mainstream, the onus will be to provide greater value from the not insignificant efforts of the people collecting the data in the first place. ■

Bergenstal RM et al (2013) *Diabetes Technol Ther* **15**: 198–21
Dawson AJ et al (2013) *Diabet Med* **30**: 1172–80
Rodbard D (2011) *Postgrad Med* **123**: 107–18
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