

## Diabetes and Real-World Investigation of Glucose Instability, Variability and Exposure in Haemodialysis Patients (DRIVE-HD) – An exploration of Factors causing Glucose Variability (GV)

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Glucose Variability (GV) is an increasingly recognised risk factor for adverse outcomes and reduced quality of life in individuals with diabetes. Both day to day and within day glucose variability (instability) have been found to correlate closely to risks of hypo- and hyperglycaemia episodes and diabetes complications. However, there remains debate over the best way to measure such GV in populations and/or individuals with diabetes.

In population studies the percent coefficient of variation (%CV) has gained consensus for assessment, however at a clinical “real-world” level more debate exists as glucose levels for an individual are not normally distributed. Consensus has however been achieved over the presentation of CGM data using a graphical representation (the Ambulatory Glucose Profile – AGP). A simple numerical measure of individual variability which is also readily identifiable visually on the AGP is the inter-quartile range (IQR) – we have therefore used this as a primary assessment metric in our cross-sectional study of individuals with diabetes treated with insulin on haemodialysis using the FreeStyle Libre Pro blinded glucose sensor.

Individuals who had worn a sensor and achieved recording of at least 7 full days of data were categorised by diabetes type and treatment and also dialysis type and timing to try and understand common drivers for GV in this high-risk population (table 1).

### Results

Timing of the dialysis session (am vs pm vs twilight) did not appear to impact on overall GV (as measured by IQR), nor did dialysis vintage or age. Those with type 1 diabetes had greater GV. Diabetes treatment had a significant impact, those individuals only requiring basal insulin for their diabetes treatment had a lower IQR (less GV) than those on either pre-mixed insulin or basal-bolus insulin ((3.6(3.1,4.6) vs 4.6(3.7,5.4) vs 4.9(4.1,6.7)mmol/L) p=0.008

During periods on dialysis (compared to the equivalent part of the day off dialysis) the IQR was reduced by nearly 40% (from 4.1mmol/L to 2.3mmol/L – p<0.001)

Glucose control was also found to vary according to time in relationship to dialysis sessions – in the 6 hours leading up to dialysis the IQR was 3.4(2.3,5.2)mmol/L whereas in the 6 hours after it was increased to 4.2(3.0,5.4)mmol/L (p=0.005).

In contrast to other populations where night-time variability is very significantly reduced compared to daytime variability, in this population group the difference between day and night IQR was very small ((4.3(3.5,5.8) vs 4.0(2.9,5.7)mmol/L – p=0.03)

### Conclusions

GV (as measured by IQR in individual patients) is a treatment target if morbidity and mortality in HD patients with diabetes is to be reduced. Factors with significant impact appear to be the diabetes treatment modality, and time relative to the period of dialysis. Before and during dialysis risk is relatively low, but rises significantly in the 6 hours following dialysis. Treatment and monitoring strategies should try to mitigate this risk.