The Minimum Frequency of Glucose Measurements from Which Glycemic Variation Can Be Consistently Assessed

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Abstract

Aims:
While there has been much debate about the clinical importance of glycemic variation (GV), little attention has been directed to the properties of data sets from which it is measured. The purpose of this study is to assess the minimum frequency of glucose measurements from which GV can be consistently and meaningfully measured.

Methods:
Forty-eight 72 h continuous glucose monitoring traces from children with type 1 diabetes were assessed. Measures of GV included standard deviation (SD), mean amplitude of glycemic excursion (MAGE), and continuous overlapping net glycemic action (CONGA). Measures of GV calculated using 5 min sampling were designated as the 100% or “best estimate” value. Calculations were then repeated for each patient using glucose values spaced at increasing intervals. For each of the specified sampling frequencies, the ratio (%) of the between-subject SD based on the reduced subset of data to the estimate of the SD based on the full 5 min sampling data set was calculated.

Results:
As the interval between observations increased, so did the variability of the estimators of GV. Standard deviation exhibited the least systematic change at all measurement intervals, and MAGE exhibited the greatest systematic change.

Conclusions:
In patients with type 1 diabetes, GV as measured by SD or CONGA becomes unreliable if observations are more than 2–4 h apart, and estimates of MAGE become unreliable if glucose measurements are more than 1 h apart. MAGE is more unstable and prone to random measurement error than either SD or CONGA. The frequency of glycemic measurements is thus pivotal when selecting a parameter for measurement of GV.


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Abbreviations: (CGM) continuous glucose monitoring, (CONGA) continuous overlapping net glycemic action, (MAGE) mean amplitude of glycemic excursion, (SD) standard deviation

Keywords: continuous glucose monitoring, continuous overlapping net glycemic action, glucose profiles, glycemic variability, mean amplitude of glycemic excursion, standard deviation, statistical experimental design

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