EFFECT OF DATA GAPS OF CONTINUOUS GLUCOSE MONITORING TRACINGS ON THE ACCURACY OF THE GLUCOSE VARIABILITY ANALYSIS

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BACKGROUND AND AIMS

Data gaps are commonly presented in continuous glucose monitoring (CGM) systems due to communication failures, intermittent sensor errors, inappropriate use of the device, sensor compression, or many others reasons [1]. However, such data gaps may affect the analysis of glucose variability obtaining misleading results in the metrics calculation [2]. Figure 1 shows some examples of data gaps present in real glucose tracings.

While some researchers have proposed methods to fill data gaps based on systematic rules of interpolation [1], others have analyzed the minimum requirements of data frequency (time interval between each valid glucose sample) in CGM tracings that have to be satisfied in order to not alter the reliability of some variability metrics [2]. However, there are problems not only with frequency but also with the length of data gaps in CMG tracings.

Although some assessment computer programs for glucose variability, as EasyGVM® [3], allow the user to modify the data gaps length to be linearly interpolated and then calculate the glucose variability metrics it offers, it is not clear yet how much this affects each metric.

Our aim is then to analyze how the reliability of several glucose variability metrics is affected by different lengths of a data gap in CGM tracings of 24-hours long.

METHODS

In order to analyze the effect of data gaps lengths on glucose variability, a CGM data base from diabetic patients with 374 tracings of 24-hours long without data gaps was used. Artificial gaps were implemented randomly in each CGM trace and then linearly interpolated in order to compare the result of several glucose variability metrics (GVM) when data gaps are present.

Figure 2 shows two examples of this procedure over CGM tracings of 48-hours long, however only 24-hours tracings are used in our analysis.

The metrics of CV, SD, MAGE, MAG, IQR, and Mean were assessed on the original CGM data days without gaps and on the corresponding CGM tracings with data gaps linearly interpolated.

Figure 3 shows the corresponding p-value obtained in the comparison test for each data gap duration. This result shows that the reliability of GVM is affected by different data gaps lengths in CGM tracings.

The relationship between data gaps duration and reliability of several GVM was assessed. Results suggest that metrics CV, SD, IQR and MAGE will suffer a lack of reliability when the length of a data gap is greater than 4 hours in a CGM trace of 24-hours long. In the case of MAGE, the length have to be greater than 6 hours.

Future work will focus on analyzing several scenarios of variation in frequency and length of data gaps not just for a day but also for additional time scales, as well as to analyze other interpolation methods that can improve reliability of GVM in the face of data gaps.

ACKNOWLEDGEMENTS

Table 1. CV: coefficient of variation, SD: standard deviation, IQR: interquartile range, MAG: mean absolute glucose, MAGE: mean amplitude of glycemic excursions. * T-test used in metrics data that comes from a normal distribution. ** Mann-Whitney U-test used in nonparametric metrics data.

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