Accuracy Analysis of Interpolation Methods on Flash Glucose Monitoring Data

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Background: Flash glucose monitoring is increasingly used by people with type 1 diabetes. Flash glucose monitoring data contains gaps between measurements with measurements only measured every 15 minutes. Estimating what the glucose is between scan readings might lead to more accurate metrics such as time in range.

Aims: To determine if statistical interpolation methods could be used to estimate what the blood glucose (BG) was between scan readings, at various blood glucose levels and different times of day, at rest and during exercise.

Methods: 36 people with Type 1 diabetes training for the Swansea half marathon completed a training diary and wore a Flash-glucose-monitor for 8 weeks prior to the event. Missing intervals within data were identified and multiple interpolation algorithms were applied to estimate BG values during gaps. Predictions were verified using manual flash measurements.

Results: Interpolated BGs correlation (R^2) with manual scanned readings were very good. However, the best method for doing the interpolation varied by time-of-day, blood glucose levels and on whether exercising or not. In addition, the variations around the estimate (RMSE) also varied by time-of-day, blood glucose levels and whether exercising or not. For example RMSE was often lower during exercise compared to at rest, with higher RMSE during day than at night.

Discussion: Interpolation might improve the accuracy of time in range of flash glucose monitoring. However different methods of interpolation will be needed to be used for different times of the day, for different blood glucoses and whether exercising or at rest.