Continuous estimation of glycosylated hemoglobin (HbA1c) based on self-monitoring blood glucose (SMBG) data and laboratory HbA1c measurements

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Background: The measurement of HbA1c is one of the most well established means to monitor glycemic control in persons with diabetes. Typically HbA1c measurements are done 2-4 times per year, even though HbA1c levels can change substantially in 3-4 weeks. This ultimately leads to unmonitored gaps. Therefore, we sought to define continuous HbA1c estimate (eA1c) to guide in day-to-day diabetes management. We present an adaptive method to calculate eA1c level using SMBG data and previous HbA1c measurements.

Materials & Methods: An estimation algorithm was constructed based on correlations between blood glucose distribution parameters and laboratory HbA1c measurements. The best linear combination of those parameters was applied to the model and individually updated scaling factors were introduced. The derived mathematical model was tested with 30 diabetic subjects. Retrospective analysis with leave-one-out cross-validation was used for model performance evaluation. Mean absolute relative deviation (MARD) of eA1c from reference HbA1c and eA1c-HbA1c correlation were calculated. Also, an error grid analysis was made.

Results: MARD was 6.17% and correlation between eA1c and reference HbA1c was strong (r=0.83). Error grid analysis showed that 82.55% of eA1c values were within 10% from reference HbA1c and 98.61% within 20% from reference.

Conclusions: Adaptive mathematical model was developed to calculate a continuous eA1c to each diabetic using their laboratory HbA1c and SMBG measurements. Results in this study show that algorithm is able to calculate eA1c reliably for diabetics with regular SMBG measurements, and algorithm works even with biased and irregular measurement patterns.

Biography
Petteri Väisänen completed a BSc and is pursuing Biomedical Engineering as his major for MSc in Tampere University of Technology, Finland. He is the Data and Algorithm Specialist at Quattro Folia, a high-tech proactive self-care service provider to those who have chronic illnesses such as diabetes.

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