

## Computing the Risk of Postprandial Hypo- and Hyperglycemia in Type 1 Diabetes Mellitus Considering Inpatient Variability and Other Sources of Uncertainty

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### Abstract

#### *Objective:*

The objective of this article was to develop a methodology to quantify the risk of suffering different grades of hypo- and hyperglycemia episodes in the postprandial state.

#### *Methods:*

Interval predictions of patient postprandial glucose were performed during a 5-hour period after a meal for a set of 3315 scenarios. Uncertainty in the patient's insulin sensitivities and carbohydrate (CHO) contents of the planned meal was considered. A normalized area under the curve of the worst-case predicted glucose excursion for severe and mild hypo- and hyperglycemia glucose ranges was obtained and weighted accordingly to their importance. As a result, a comprehensive risk measure was obtained. A reference model of preprandial glucose values representing the behavior in different ranges was chosen by a  $\chi^2$  test. The relationship between the computed risk index and the probability of occurrence of events was analyzed for these reference models through 19,500 Monte Carlo simulations.

#### *Results:*

The obtained reference models for each preprandial glucose range were 100, 160, and 220 mg/dl. A relationship between the risk index ranges <10, 10–60, 60–120, and >120 and the probability of occurrence of mild and severe postprandial hyper- and hypoglycemia can be derived.

#### *Conclusions:*

When inpatient variability and uncertainty in the CHO content of the meal are considered, a safer prediction of possible hyper- and hypoglycemia episodes induced by the tested insulin therapy can be calculated.

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**Abbreviations:** (CHO) carbohydrates, (MIA) modal interval analysis, (RI) risk index, (T1DM) type 1 diabetes mellitus

**Keywords:** blood glucose, glucose variability, interval analysis, simulation, type 1 diabetes mellitus

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