# Clinically Significant Disagreement between Mean Blood Glucose and Estimated Average Glucose in Two Populations: Implications for Diabetes Management

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# Abstract

## Background:

Hemoglobin A1c (HbA1c) is highly correlated with mean blood glucose (MBG) levels and widely used in assessment of diabetes therapy. It has been proposed to report HbA1c in terms of an estimated average glucose (eAG) derived from the population regression of MBG on HbA1c. Pertinent to the clinical utility of eAG would be the degree of agreement between eAG and MBG estimated from multiple sampled glucose measurements over time.

### Methods:

We examined agreement between eAG and MBG by Bland–Altman analysis from two different populations of type 1 diabetes patients: 150 children at our clinic in New Orleans and publicly available data from 1440 participants in the Diabetes Control and Complications Trial (DCCT). In New Orleans, MBG was derived from the mean of each patient's self-monitored glucose records over the 3 months before the HbA1c was obtained at the patient's clinic visit. Hemoglobin A1c was traceable to the DCCT. In DCCT participants, MBG was calculated from the patient's seven-sample glucose profile set submitted during each quarterly visit. Estimated average glucose was calculated from each individual's HbA1c using a previously reported regression equation of MBG versus HbA1c, eAG = (HbA1c \* 28.7) - 47.7, derived from a continuous glucose monitoring protocol over a 12-week period.

### Results:

The analysis showed that there is frequent and clinically significant disagreement between MBG and eAG. Estimated average glucose over or under estimated MBG by 28.7 mg/dl or greater (HbA1c difference of 1% or greater) in approximately 33% of patients from both populations. The eAG overestimation of MBG was highest at lower MBG. The difference between eAG and MBG was skewed upward with increasing mean of eAG and MBG in the DCCT.

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Abbreviations: (ADAG) A1c-derived average glucose, (CHNOLA) Children's Hospital of New Orleans, (DCCT) Diabetes Control and Complications Trial, (eAG) estimated average glucose, (HbA1c) hemoglobin A1c, (LOA) limits of agreement, (MBG) mean blood glucose, (SD) standard deviation

Keywords: estimated average glucose, glycated hemoglobin, hemoglobin A1c, mean blood glucose

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#### Abstract cont.

#### Conclusions:

Frequent discordance between eAG and MBG in clinical practice will likely be confusing to patients and clinicians. In patients where eAG overestimates MBG, intensive management based on eAG alone will likely lead to greater frequency of hypoglycemic episodes. To overcome these limitations of eAG, a customized assessment of HbA1c with respect to a patient's MBG should be performed using directly monitored patient glucose levels over time.

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