

Multiplicative Surrogate Standard Deviation: A Group Metric for the Glycemic Variability of Individual Hospitalized Patients

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Abstract

Objective:

Group metrics are described to quantify blood glucose (BG) variability of hospitalized patients.

Methods:

The “multiplicative surrogate standard deviation” (MSSD) is the reverse-transformed group mean of the standard deviations (SDs) of the logarithmically transformed BG data set of each patient. The “geometric group mean” (GGM) is the reverse-transformed group mean of the means of the logarithmically transformed BG data set of each patient. Before reverse transformation is performed, the mean of means and mean of SDs each has its own SD, which becomes a multiplicative standard deviation (MSD) after reverse transformation. Statistical predictions and comparisons of parametric or nonparametric tests remain valid after reverse transformation. A subset of a previously published BG data set of 20 critically ill patients from the first 72 h of treatment under the SPRINT protocol was transformed logarithmically. After rank ordering according to the SD of the logarithmically transformed BG data of each patient, the cohort was divided into two equal groups, those having lower or higher variability.

Results:

For the entire cohort, the GGM was 106 (\pm/\times 1.07) mg/dl, and MSSD was 1.24 (\pm/\times 1.07). For the subgroups having lower and higher variability, respectively, the GGM did not differ, 104 (\pm/\times 1.07) versus 109 (\pm/\times 1.07) mg/dl, but the MSSD differed, 1.17 (\pm/\times 1.03) versus 1.31 (\pm/\times 1.05), $p = .00004$.

Conclusions:

By using the MSSD with its MSD, groups can be characterized and compared according to glycemic variability of individual patient members.

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Abbreviations: (BG) blood glucose, (GGM) geometric group mean, (MSD) multiplicative standard deviation, (MSSD) multiplicative surrogate standard deviation, (SD) standard deviation

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