STRENGTHS AND LIMITATIONS OF NEW APPROACHES FOR GRAPHICAL PRESENTATION OF BLOOD GLUCOSE MONITORING SYSTEM ACCURACY DATA

Stefan Pleus[1], Frank Flacke[2], Jochen Sieber[2], Cornelia Haug[1], Guido Freckmann[1]

[1]Institut für Diabetes-Technologie Forschungs- und Entwicklungsgesellschaft mbH an der Universität Ulm, Ulm, Germany, [2]Sanofi, Frankfurt, Germany

OBJECTIVE:

- System accuracy evaluations of blood glucose monitoring systems (BGMS) typically include graphical presentations such as traditional difference plots (DPs).[1,2]
- More recently, 3 new approaches to assess analytical performance of blood glucose monitoring systems were introduced, including radar plots (RPs),[3] rectangle target plots (RTPs),[4] and surveillance error grids (SEGs).[5]
- With the introduction of these new graphical presentations of BGMS accuracy, it is important to demonstrate their respective comparative strengths and limitations.

METHOD:

- Data from 4 system accuracy evaluations (2× BGStar, 1× MyStar Extra, 1× MyStar DoseCoach; Agamatrix Inc., Salem, NH) were analyzed in RPs, RTPs, and SEGs. These new plots were compared with traditional DPs to establish their respective strengths and limitations.

- **Difference plot[1,2]:** Difference between test system result and comparison method result plotted over comparison method result, sometimes called "modified Bland-Altman plot", recommended in ISO 151972. High accuracy is represented by values close to the zero line.
- **Radar plot[3]:** The differences define the location (distance from the center of the plot; positive sign: upper half, negative sign: lower half), whereas the direction (angle with respect to the center of the plot) depends on the comparison method result. Differences are in mg/dl at <100 mg/dl and in % at ≥100 mg/dl. High accuracy is represented by values close to the center.
- **Rectangle target plot[4]:** Differences are categorized (<100 mg/dl or ≥100 mg/dl), then intervals are calculated based on mean and standard deviation. Rectangles show the cross-section of the two intervals. High accuracy is represented by small rectangles whose center is close to the center of the plot.

- **Surveillance error grid[5]:** Individual results are categorized by clinical risk. High accuracy is represented by values close to the line of identity. SEG analysis software was kindly provided by its developer Christian Wakeman, University of Virginia.

RESULTS (FIGURES 1, 2, 3, AND 4):

- Plots with individual data points (DPs, RPs, SEGs) allow for more detailed assessment of data than RTPs, in which data are sorted into 1 of 2 categories (<100 mg/dL or ≥100 mg/dL) and then averaged.
- DPs and RPs become harder to read with increasing numbers of data points, whereas RTPs are not affected, so showing and comparing data from different BGMS is easier.
- RTPs also provide more easily accessible information about trueness and precision (location and size of the rectangle).

- SEGs have the advantage of having many data points and also provide risk estimation.
- Overall assessment of accuracy may be easier in RPs or RTPs, because a small size of the data point cluster or rectangle indicates high accuracy.

CONCLUSION:

Both the traditional DP plots, as well as the newly introduced graphical presentations of BGMS accuracy, have different strengths and limitations. Selecting a specific type depends mostly on the kind of information sought; the comparative information presented here hopes to provide additional insight and guidance into the unique characteristics of the graphical presentations now made available.

FIGURE 1: Difference Plot (DP), Radar Plot (RP), Rectangle Target Plot (RTP), and Surveillance Error Grid (SEG) for BGStar, 1st study
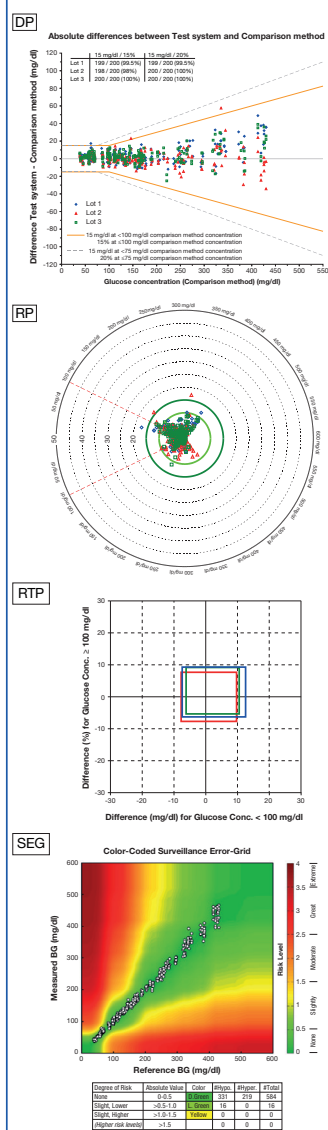

FIGURE 2: Difference Plot (DP), Radar Plot (RP), Rectangle Target Plot (RTP), and Surveillance Error Grid (SEG) for BGStar, 2nd study
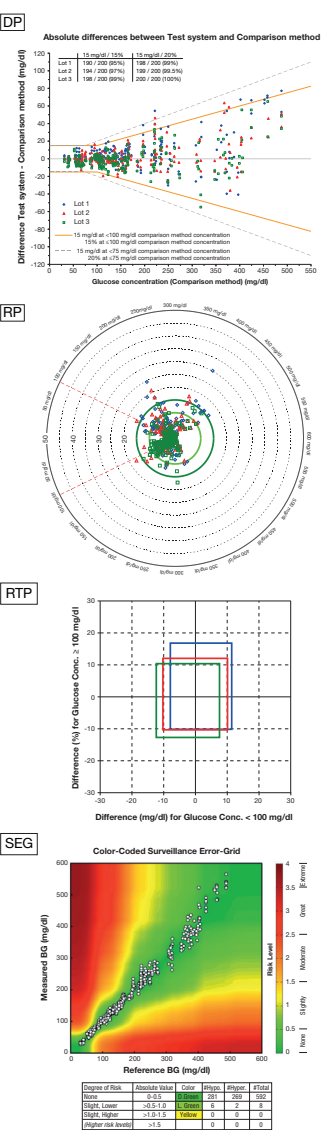

FIGURE 3: Difference Plot (DP), Radar Plot (RP), Rectangle Target Plot (RTP), and Surveillance Error Grid (SEG) for MyStar Extra
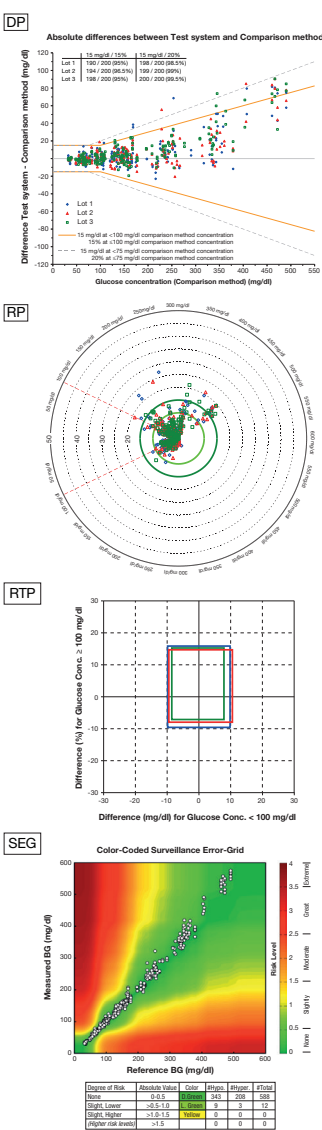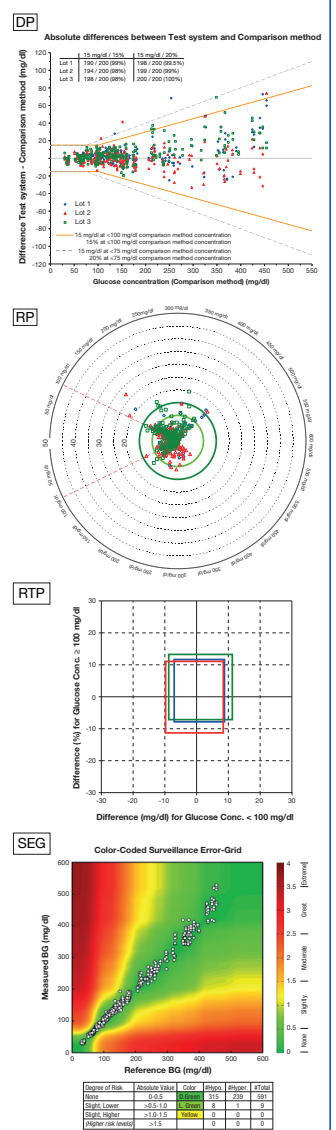

FIGURE 4: Difference Plot (DP), Radar Plot (RP), Rectangle Target Plot (RTP), and Surveillance Error Grid (SEG) for MyStar DoseCoach

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