An R Package for Analysis of Continuous Glucose Monitor Data

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Objective

- To develop a standardized, free, open-source method for data management and analysis of continuous glucose monitor (CGM) data.
- Calculate the key metrics recommended in the International Consensus on Use of Continuous Glucose Monitoring.
- Provide graphical tools similar to the Ambulatory Glucose Profile (AGP).

Methods

- We wrote a package in the freely available statistical programming language R (R Foundation for Statistical Computing, Vienna, Austria).
- Summary variables and aggregate daily overlays were compared to proprietary CGM software (only one device shown here).
- Proprietary software does not calculate MAGE or other more complex variables, so these were not compared.

cgmanalysis vs. iPro 2
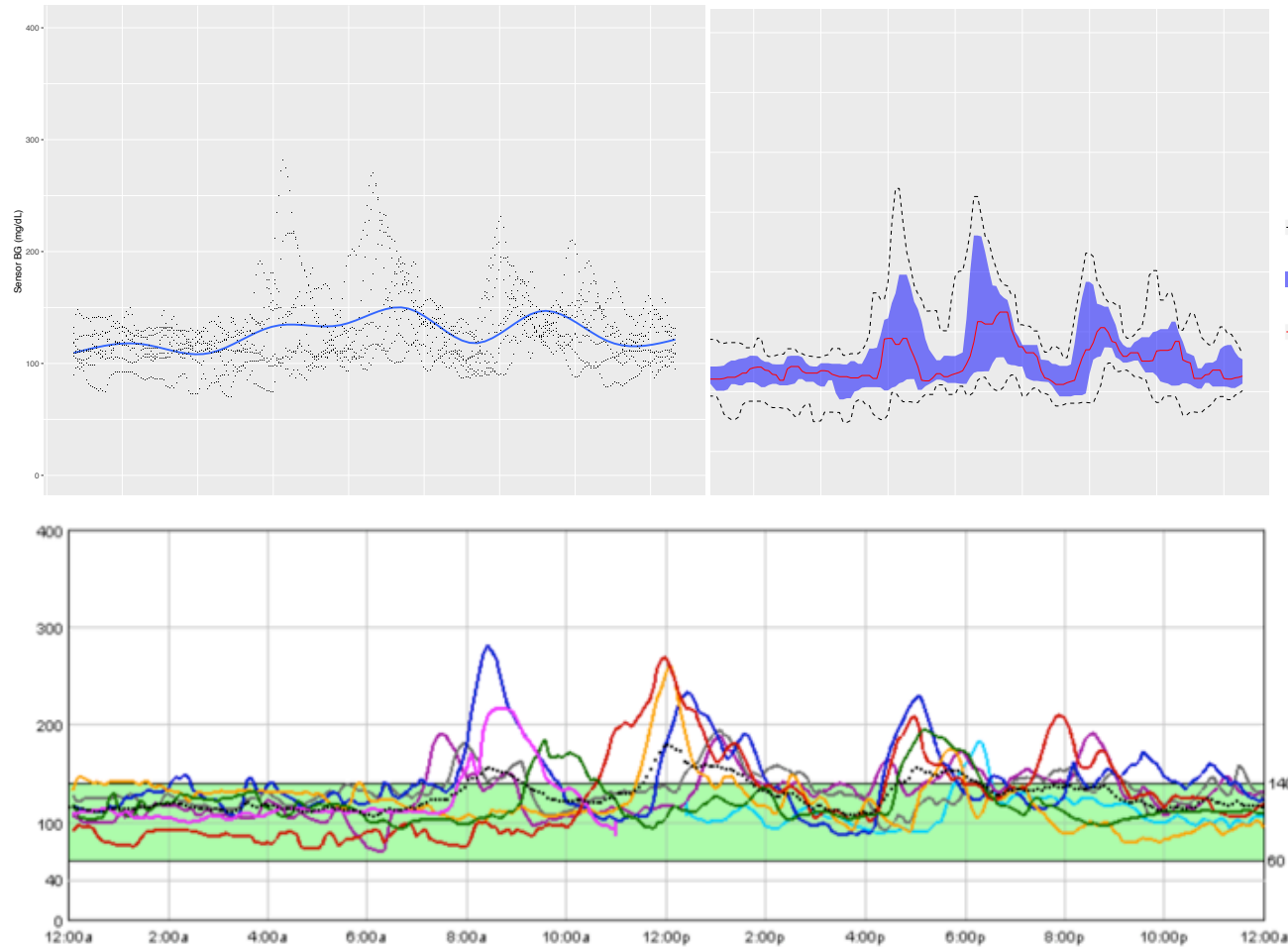
	cgmanalysis	iPro
# Sensor Values	2000	2000
Highest	282	282
Lowest	70	70
Average	126.87	127
Standard Dev	30.79	31
# High Excursions	31	32
# Low Excursions	0	0
% Time Above 140	24.85	24
% Time Below 60	0	0

cgmanalysis vs. Dexcom Clarity
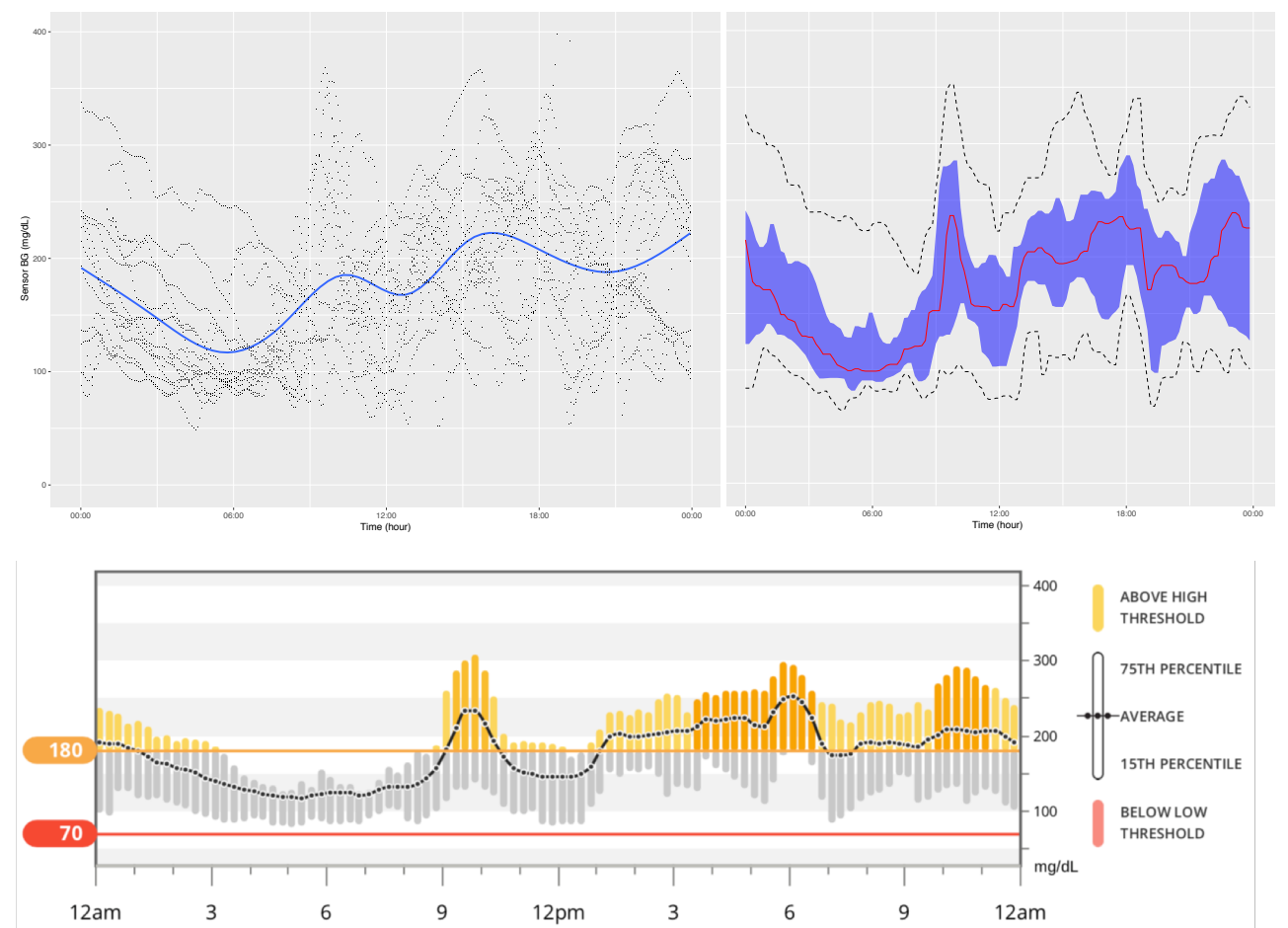
	cgmanalysis	Dexcom Clarity
Average	175.679	176
Standard Dev	67.097	68
Time in Range	55.657	56

Results

- Summary variables calculated by our package compare well to those generated by various CGM software.
- Our functions increase the number and complexity of summary measures readily available to clinicians and researchers.

Conclusions

- Consistent handling of CGM data using our R package will allow for collaboration between research groups and contribute to a better understanding of free-living glucose patterns.

Calculated Variables

Percent CGM wear
Average sensor glucose
Sensor glucose standard deviation
Sensor glucose coefficient of variation
Minimum sensor glucose
Maximum sensor glucose
Sensor glucose quartiles
Variables above for daytime and nighttime periods
Estimated A1c (eA1c)
Glucose management indicator (GMI)
Excursions, minutes and % time above/below threshold
Minutes and % time in range (70 – 180 mg/dL)
Area under the curve (trapezoidal rule)
Mean amplitude of glycemic excursions (MAGE)
J index
Continuous overall net glycemic action (CONGA)
Mean of daily differences (MODD)
Low blood glucose index (LBGI)
High blood glucose index (HBGI)