Title
Diametrics: A User-Friendly Web Tool for Custom Analysis of Continuous Glucose Monitoring Data

Author List

Corresponding author: Catherine L Russon, University of Exeter Medical School, cr591@exeter.ac.uk, https://orcid.org/0000-0001-6785-6477.

Michael J Allen, University of Exeter Medical School, m.allen@exeter.ac.uk, https://orcid.org/0000-0002-8746-9957.

Richard M Pulsford, Public Health and Sport Science, University of Exeter, r.pulsford@exeter.ac.uk, https://orcid.org/0000-0001-6880-7597.

Michael Saunby, Research Software Engineering, University of Exeter, M.Saunby@exeter.ac.uk, https://orcid.org/0009-0008-8151-499X.

Neil Vaughan, University of Exeter Medical School, n.vaughan@exeter.ac.uk, https://orcid.org/0000-0001-5038-6560.

Matthew Cocks, School of Sport and Exercise Sciences, Liverpool John Moores University, m.s.cocks@ljmu.ac.uk, https://orcid.org/0000-0003-1671-8714.

Katie L Hesketh, School of Sport, Exercise and Rehabilitation Sciences, University of Birmingham, K.L.Hesketh@bham.ac.uk, https://orcid.org/0000-0003-3409-3906

Jonathan L Low, School of Health and Exercise Science, University of British Columbia - Okanagan, jllow@mail.ubc.ca, https://orcid.org/0000-0002-1964-6237.

Robert C Andrews, University of Exeter Medical School, R.C.Andrews@exeter.ac.uk, https://orcid.org/0000-0003-4939-1738.

Abbreviations

ADA - American Diabetes Association

CGM - Continuous Glucose Monitoring

Key words

1. Continuous Glucose Monitoring (CGM)

2. Web Application

3. Glycemic Analysis

4. Event-specific Analysis

5. Metrics

6. Open-source

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During the course of preparing this work, the authors used ChatGPT and Copilot for the purpose of summarizing research papers, text editing, and providing code snippets. Following the use of this tool/service, the authors formally reviewed the content for its accuracy and edited it as necessary. The authors take full responsibility for all the content of this publication.

Figures and table count

1 figure

Letter

Continuous Glucose Monitoring (CGM) systems have revolutionized diabetes management by providing real-time blood glucose tracking. However, there is a need for free, easily accessible tools for analysis of CGM data in relation to specific events like meals or exercise, allowing improved understanding of the effects of lifestyle factors and physiological changes on glucose control. Currently, the complexity of such analyses often requires extensive technical skills, thus restricting use among the majority of researchers and clinicians. Developing user-friendly web applications to facilitate this analysis could significantly broaden accessibility and utility.

To address this, we developed *Diametrics*, a web-based application designed to make CGM data analysis both accessible and user-friendly. *Diametrics* supports a variety of CGM devices and data formats, offering a flexible platform suitable for diverse clinical and research needs. Its intuitive interface allows users to navigate and analyze data with ease, without requiring extensive technical knowledge. *Diametrics* is free to use at https://diametrics.org and is accompanied by comprehensive documentation and instruction videos. All underlying code is publicly available at https://github.com/cafoala/diametrics-webapp.

glycemic variability	rGV	GlyCulator	iglu	Diametrics
Number of days CGM worn		✓	✓	✓
Active time %		✓	✓	✓
Mean glucose	✓	✓	✓	✓
Glucose management indicator	✓	✓	✓	✓
glycemic variability (%CV)	✓	✓	✓	✓
Time above/in/below range	✓	✓	✓	✓
Ambulatory glucose profile		✓	✓	✓
Day and night		✓	✓	✓
User flexibility				
Easy switch between units				✓
Adjustable thresholds for time in range	✓	✓		✓
Adjustable thresholds for glycemic events			✓	✓
Adjustable day/night time			✓	✓
Able to link glucose to other data				✓
Multiple periods selection for analysis				✓
Calculate metrics for specific time periods				✓
Interactive visualizations				✓
File upload				
Medtronic		✓	✓	✓
Abbott		✓	✓	✓
Dexcom		✓	✓	✓
User defined	✓	✓	✓	
File preparation				
Period selection for analysis		✓		✓
Missing data imputation		✓		✓
Multiple file processing		✓	✓	✓
Many-to-single file merge		✓		✓
Sharing and access				
Graphical user interface	✓	✓	✓	✓
Online platform	✓	✓	✓	✓
Programmatic access	R	Python	R	Python
Open source			✓	✓

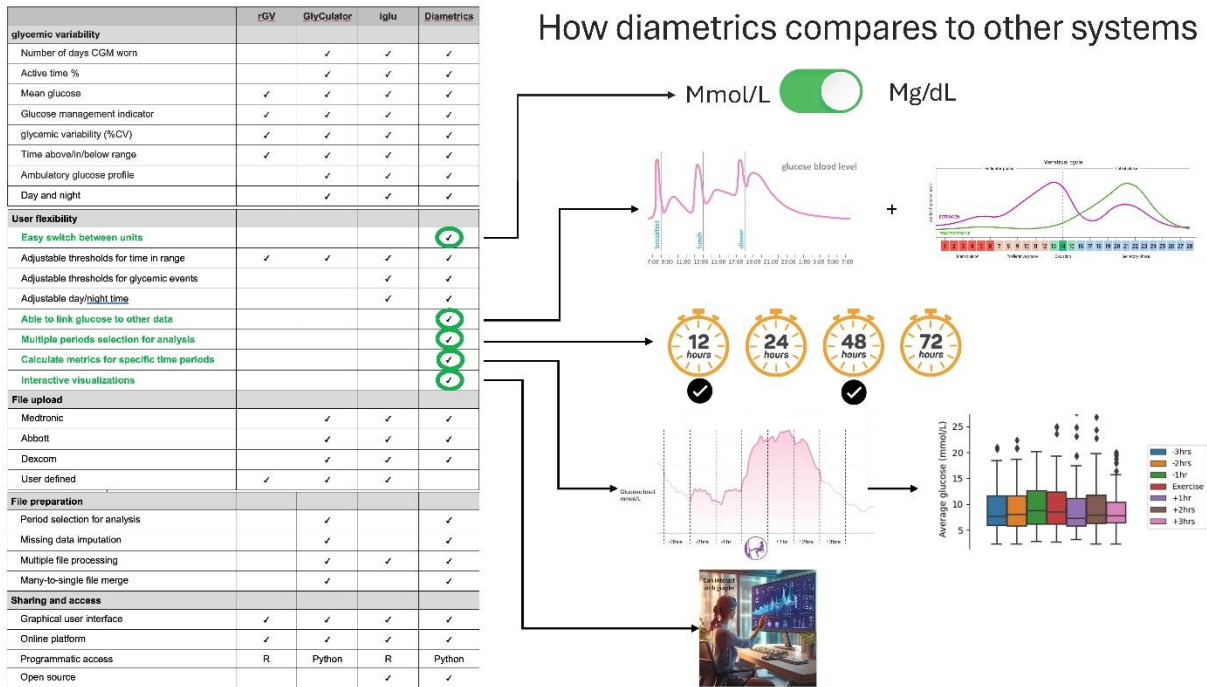How diametrics compares to other systems

Mmol/L Mg/dL

Figure 1. Novel features of *Diametrics*, compared to existing CGM analysis tools.

As well as having the standard features available across existing online CGMs analysis tools, *Diametrics* has a number of novel features (Figure 1). These include capacity for simultaneous upload of multiple CGM files, customizable analysis options that can cater to specific research or clinical questions, and interactive data visualizations. Beyond simple extraction and analysis of clinical CGM metrics, *Diametrics* has the unique capacity for custom integration and analysis of glucose data related to specific events such as meals, exercise, or medication intake. This functionality not only enhances the usability of CGM technology but also opens new avenues for personalized diabetes management and research by significantly improving our understanding of glucose dynamics at points of interest. A case study demonstrating the functionality of *Diametrics* is available at https://youtu.be/bfiQRGhCLh4.

We validated *Diametrics* through a comparative analysis with the *iglu* R package, a well-established tool for CGM data analysis [1]. Utilizing data from 418 participants from three studies [2-4], we examined agreement between *Diametrics* and *iglu* in computation of metrics recommended by the American Diabetes Association [5], including average glucose levels, time in ranges, and glycemic variability indices. We observed high concordance between *Diametrics* and *iglu*, with very high correlation (r>0.999) and near perfect agreement for all metrics [6]. This high level of concordance underscores the accuracy of *Diametrics* in replicating essential CGM metrics, validating its efficacy.

In conclusion, *Diametrics* represents a significant advancement in the field of diabetes technology. By simplifying and democratizing the analysis of CGM data, it holds the promise of enhancing diabetes management and research, making advanced data analysis accessible to a broader audience. *Diametrics* has the potential to be a valuable tool for both clinicians and researchers, facilitating better outcomes in diabetes care and fostering further research into personalized diabetes management strategies.

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