cgmViz: a web application for visualizing continuous glucose monitor data

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Background

- People with diabetes have trouble controlling their blood glucose (BG).
- Continuous glucose monitors (CGMs) are devices that people wear for 7 - 14 days which measure sensor glucose (SG) every 5 - 15 minutes.
- There are several popular CGM brands, all of which have proprietary software. This makes it impossible for clinicians to look at data in aggregate, and CGM reports can be difficult to compare across companies.
- Research clinicians will also find this tool useful in exploratory/hypothesis generating analyses.

The data

- 50 CGM data files from 3 different brands, with one file per person and approximately 3,500 measurements per file.
- The traditional method of visualizing CGM data is to average a person's SG at each 5 minute interval during the day.
  - Called the aggregate glucose profile (AGP)
- Time in range (TIR), the percentage of total CGM time that a person's SG is within a given range, is an important metric that is slowly replacing older diabetes outcomes like HbA1c or mean glucose.
  - There are common clinical guidelines for optimal range (usually 70 - 180 mg/dL), but clinicians often want to look at custom ranges.
- Mean glucose, standard deviation (SD), and coefficient of variation (CV) are also common.

Tasks

Clinicians would like to:

1. C*ompare* each patient to an “ideal” patient, or compare groups based on demographic variables. For example do women have better glucose control than men?
2. *Identify* and *discover* trends, outliers, and features. For example, are patients overall experiencing high sugar levels after lunch?
3. *Summarize* glucose control in the patients of interest.
4. *Enjoy* using this tool. CGM data is often an enormous pain, especially when dealing with multiple systems, so I want this tool to ease some of that burden.

The AGP

TIR Stacked Bar Chart

Summary Boxplots

Sortable Table (With Highlighted Cells!)

Some of the many limitations

- It isn’t particularly responsive.
  - Will work on caching figures for each state, so that they are only generated once.
- Related to the responsiveness problems, the tool can currently handle only about 30 files. This is probably fine for clinical use, but researchers may want to visualize more.
- The layout is not particularly nice looking.
- Many of the interactions are sort of guesswork, and need clarification with clinicians.
- Including demographic variables requires some pre-processing, and the tool will need to include many more than it currently does.
- Visualizations are not very innovative.

Questions?