

# **Quantifying Diabetes**

**Lessons learned from 100,000+ blood glucose readings**

Jana E. Beck

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    - = matched to carbohydrates consumed, roughly

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- using an insulin pump since 12/2006:



# My Type 1 Diabetes, Cont'd

started using a Dexcom Continuous Glucose Monitor last year:



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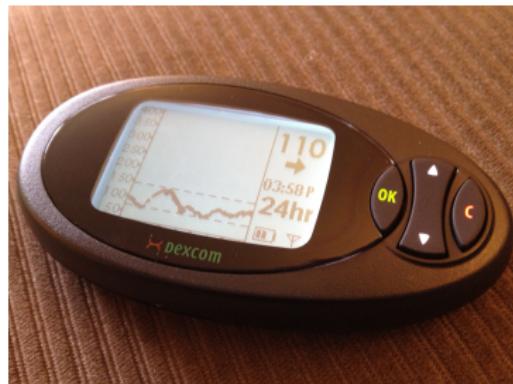
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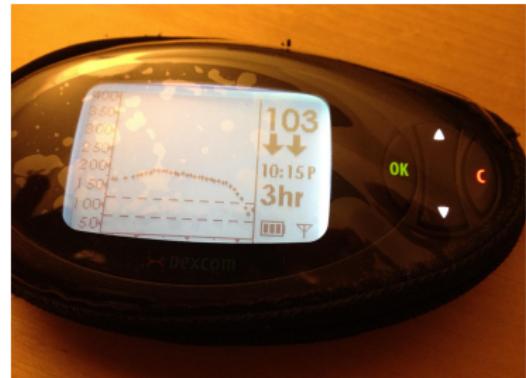
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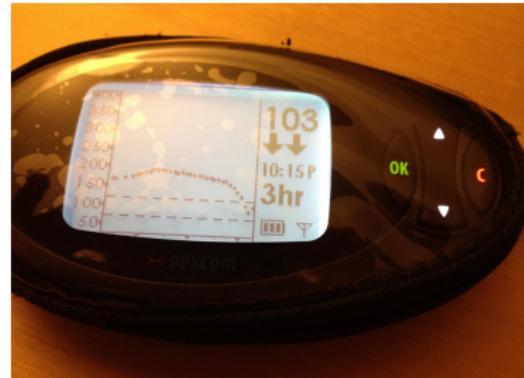
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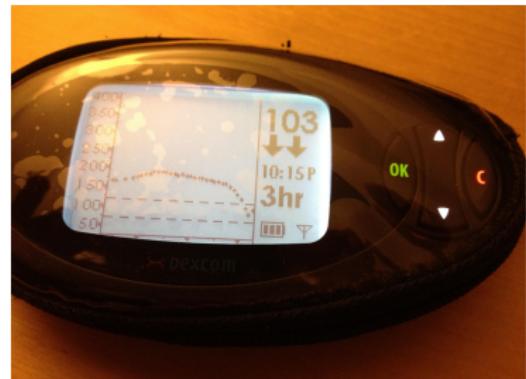
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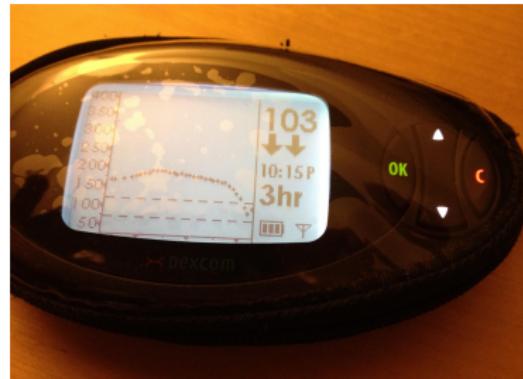
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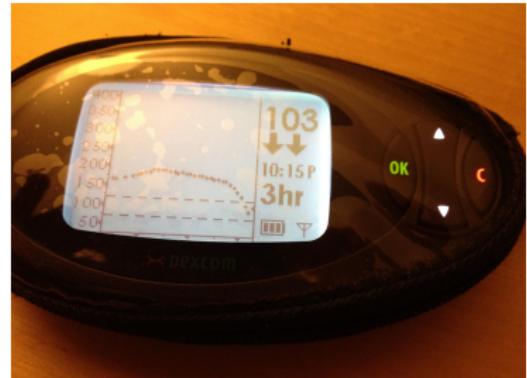
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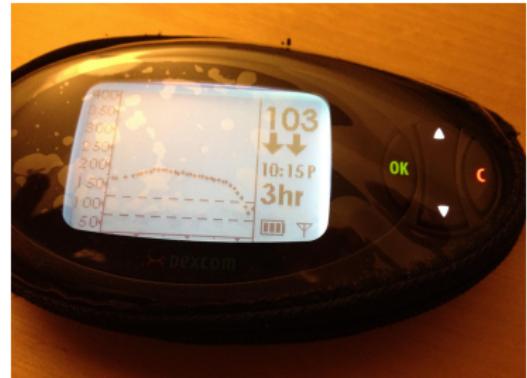
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  - ability to download data!



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  - reduce mean

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- first experience with Dexcom = *shock*
- next = **frustration**

# My Experiment, Cont'd

## Hypothesis

*Carbohydrate restriction is an effective way to improve blood glucose outcomes.*

# Inspiration

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*When I hear a physician saying to a type 1 diabetes patient, “Go ahead and eat whatever you want, just make sure you cover your glucose with insulin,” it’s like telling a firefighter, “Just go ahead and pour as much gasoline as you like on that fire you’re trying to put out, as long as you cover it with enough water.”*

— Dr. Peter Attia

# Tools

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  - tab-delimited .csv files, useful for direct importing into R

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- in [R](#):
  - built-in non-parametric statistical functions
  - built-in plotting functions: `boxplot()`, etc.
  - [ggplot2](#)

# Statistical Significance

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- **Conclusion:** change in diet resulted in significant (negative) change in blood glucose values

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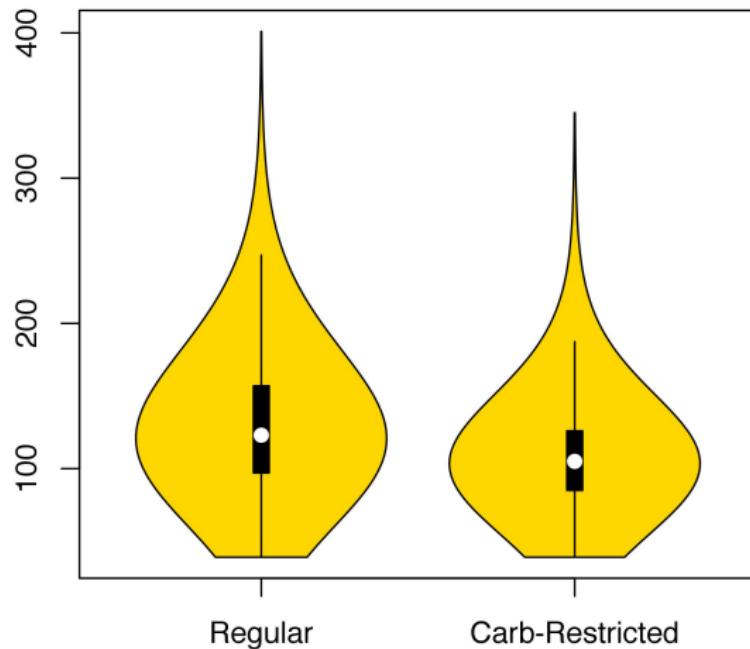
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*Did adopting a carbohydrate-restricted diet starting January 1st, 2012 result in a statistically significant difference in blood glucose?*

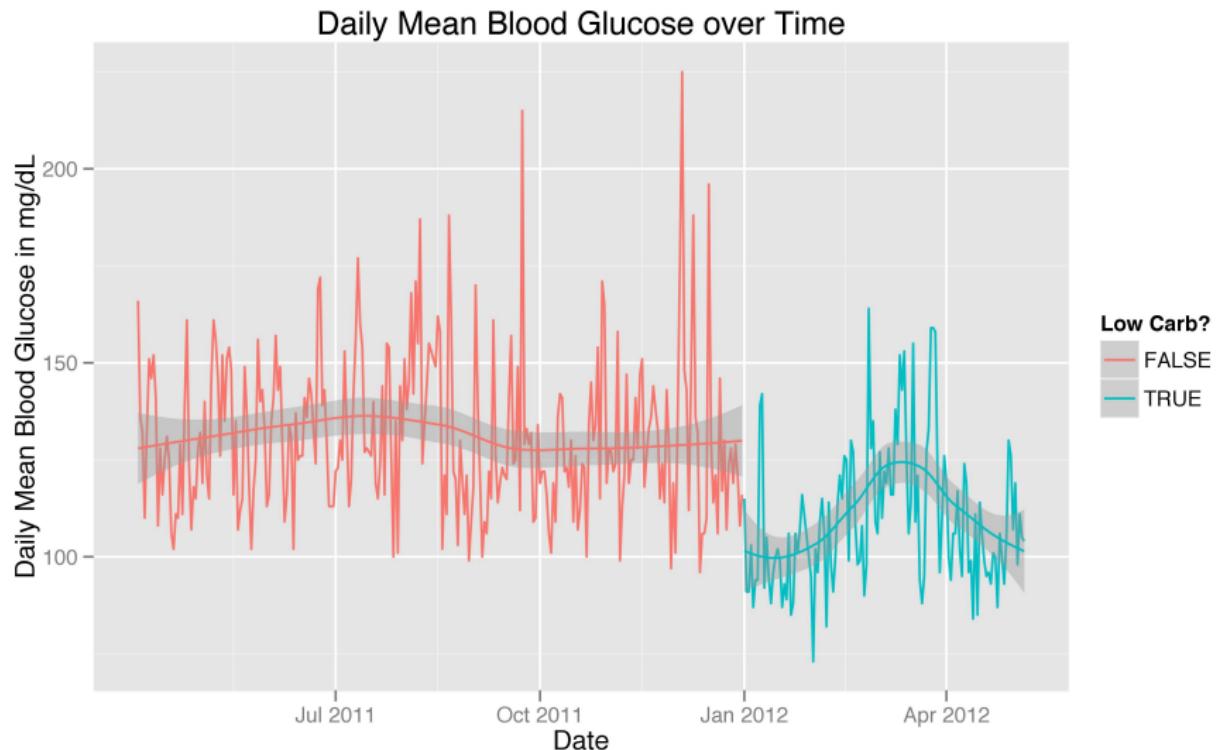
Wilcoxon rank-sum test:

- similar to the Student's t-test, but for non-parametric (= non-normally-distributed) data
- p-value < 2.2e-16
- **Conclusion:** change in diet resulted in significant (negative) change in blood glucose values
- estimate of the median of the difference between a sample from regular diet blood glucose data and a sample from low-carb diet data is **about -19 mg/dL**

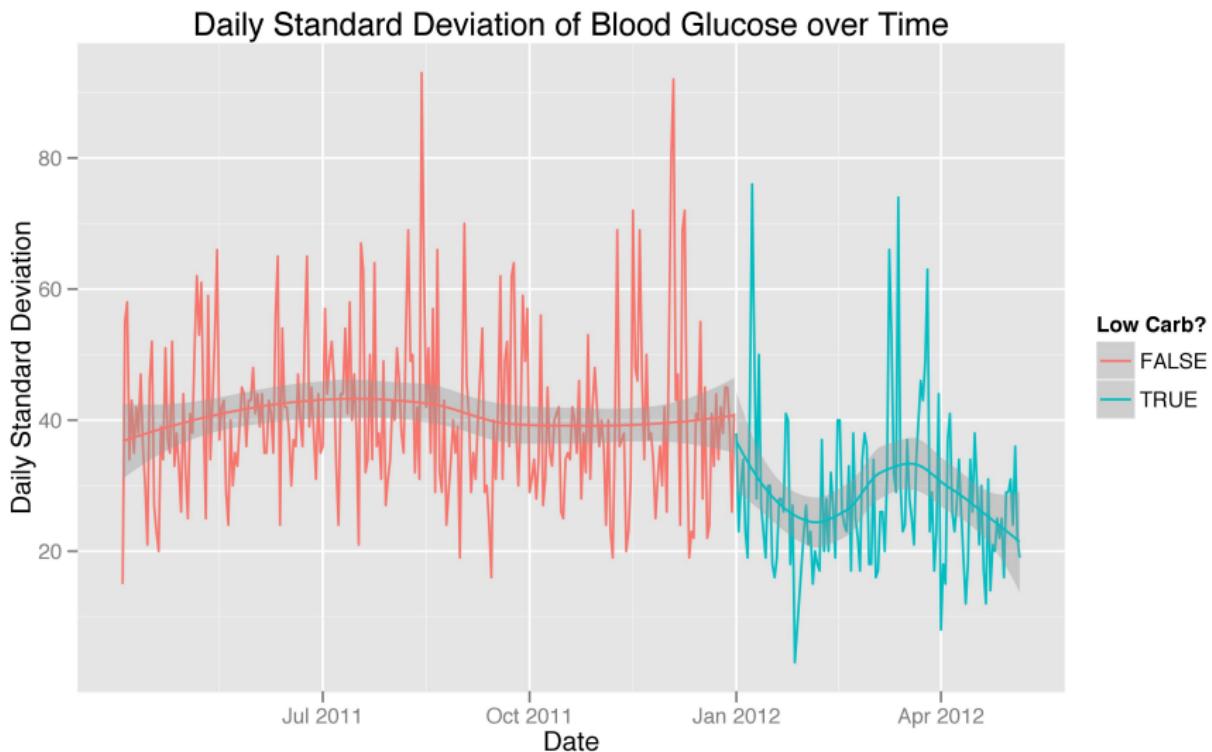
# Visualizing Change: Violin Plot



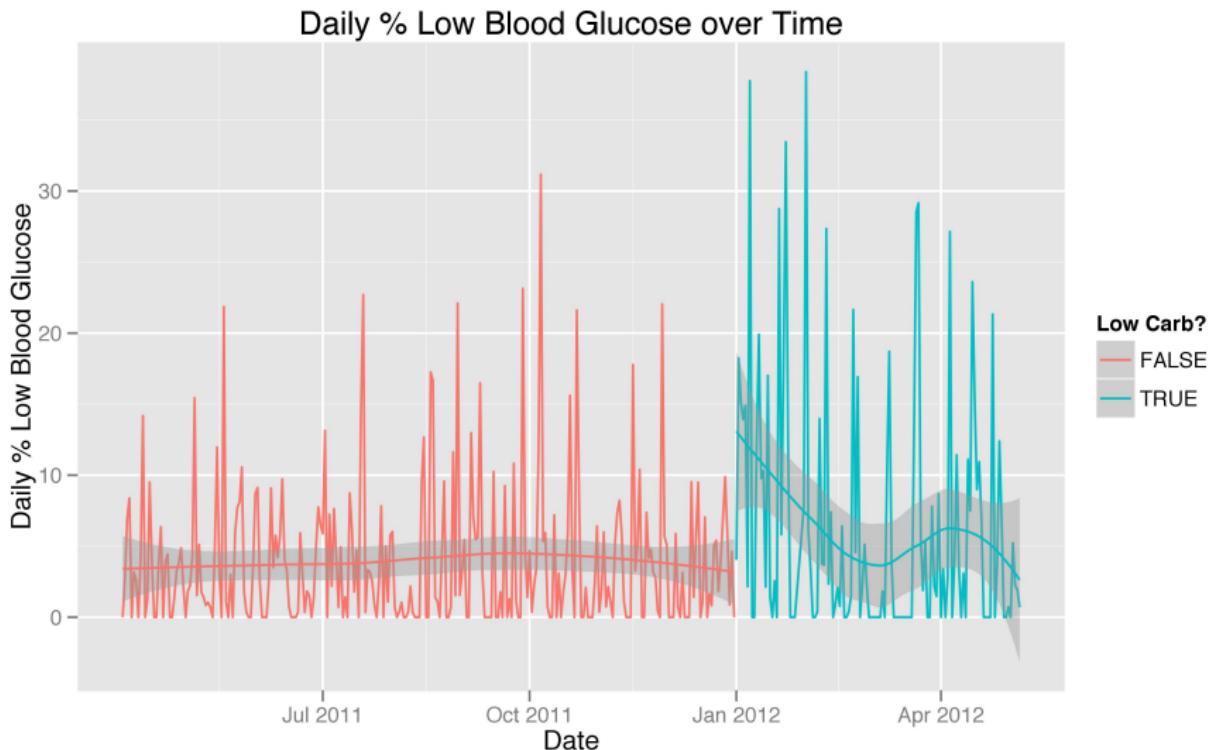
# Visualizing Change: Daily Mean over Time



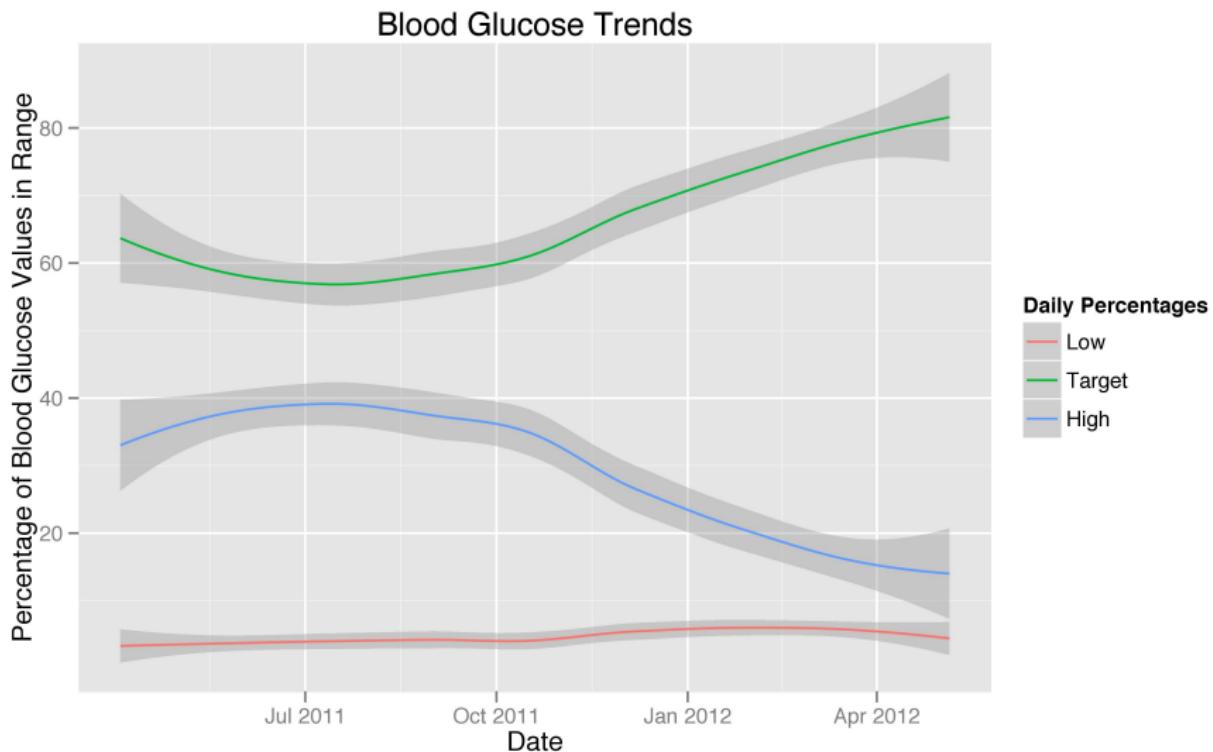
# Visualizing Change: Daily Std. Deviation over Time



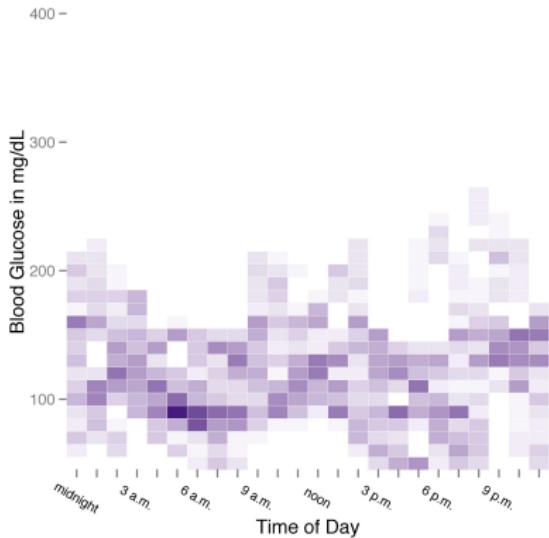
# Visualizing Change: Daily % Low over Time



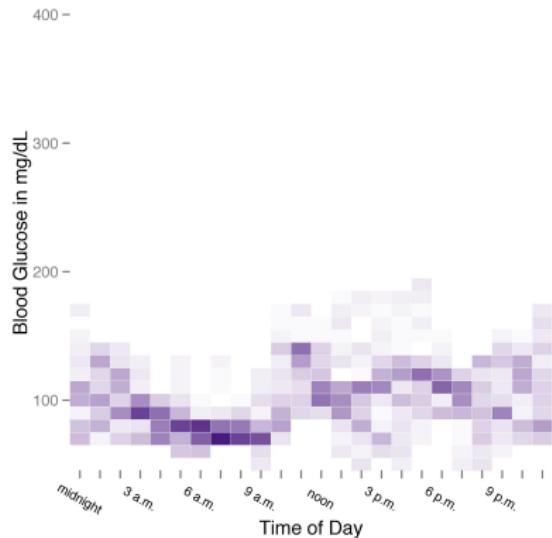
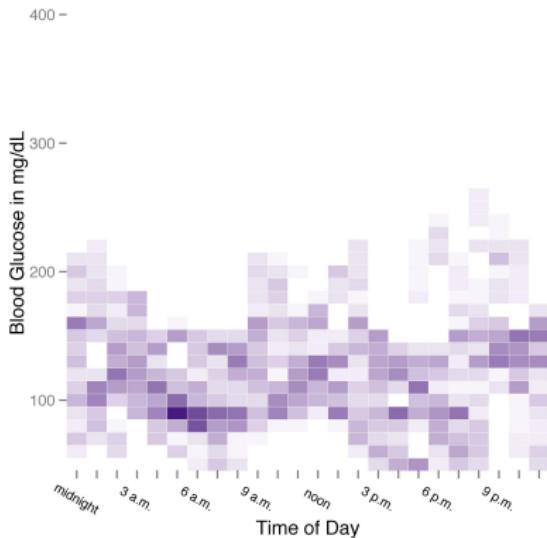
# Visualizing Change: Daily Percentages over Time



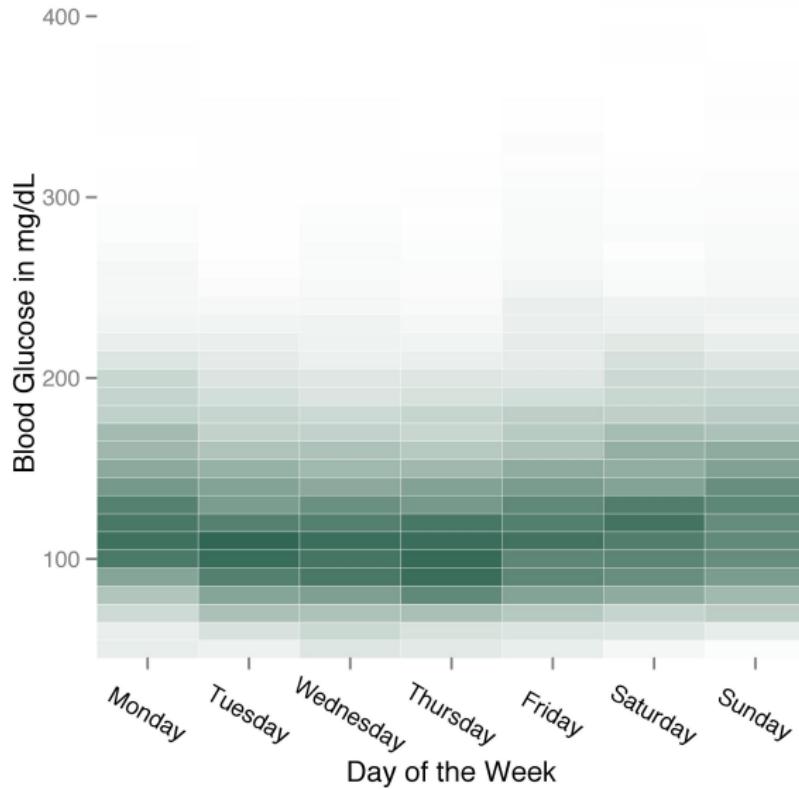
# Visualizing Change: Heatmaps



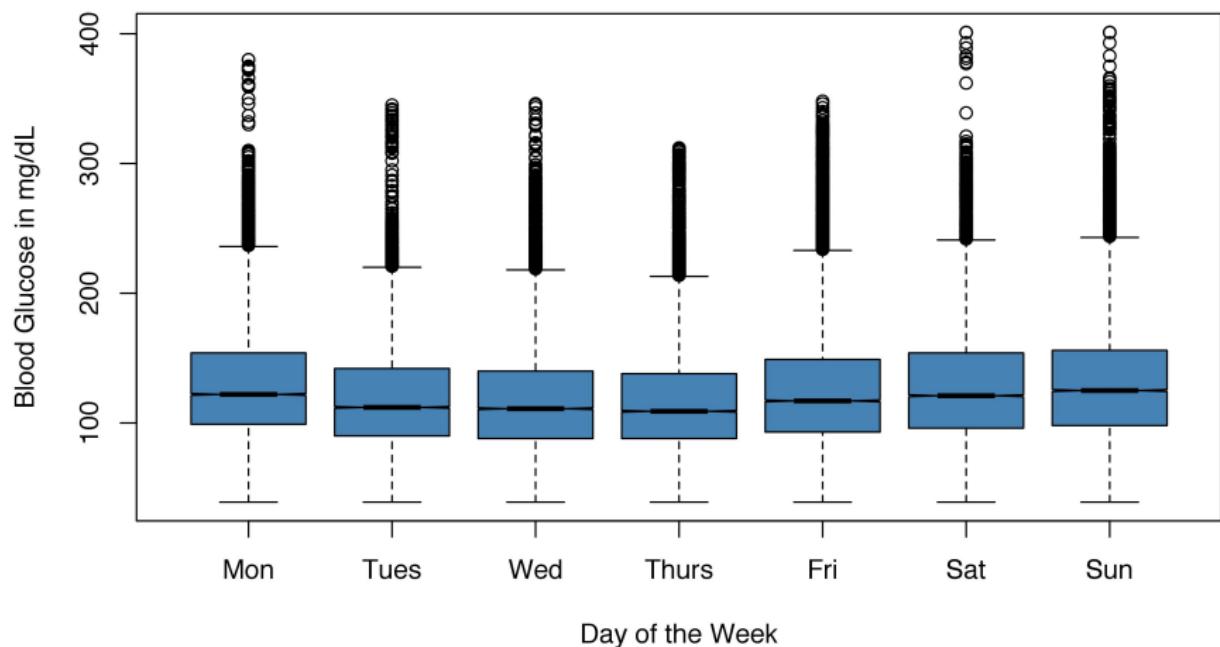
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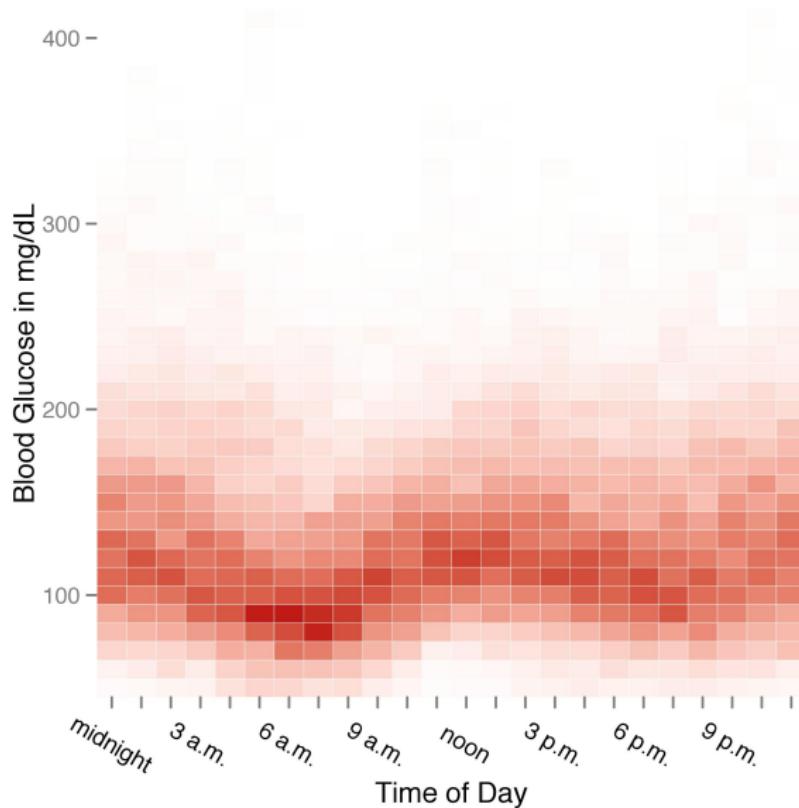
# Patterns: Day of the Week



# Patterns: Day of the Week Cont'd



# Patterns: Time of Day



# Thanks!

Contact: [jana.eliz.beck@gmail.com](mailto:jana.eliz.beck@gmail.com)

Upcoming Project: <https://github.com/jbeck/iPancreas>  
(Description here: <http://jebeck.github.com/iPancreas/>)