

Visualizing Real Time Data from Mobile Health Technologies

Student Team: Daniel Blue, Susie Choi, & Eleanor Wood | Faculty Lead: Ryan Shaw | Mentor: Michael Lindon
Contact: daniel.bass.blue@duke.edu, susie.choi@duke.edu, eleanor.wood@duke.edu

Problem

Type II diabetics must cautiously manage their health between episodic visits to the doctor, while clinicians do not receive the honest insight into patient health that is necessary to offer informed health recommendations.

Solution

Mobile health technologies (e.g. FitBit) allow users to nearly effortlessly track health metrics throughout their day.

Driving Question

What interactive interfaces can be created from Type II diabetics' mobile health data that:

1. Encourage patient self-management, and
2. Effectively inform clinicians about patient behaviors between visits?

Mobile Health Devices & Data

FitBit

- Activity level & duration
- Steps
- Sleep



Bluetooth Glucometer

- Blood glucose
- Exact & relative time (breakfast/lunch/dinner, before/after meal)

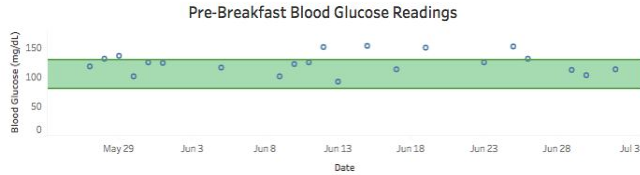


Bluetooth Scale

- Weight
- Legitimacy indication (true/false, based on 10% range check)

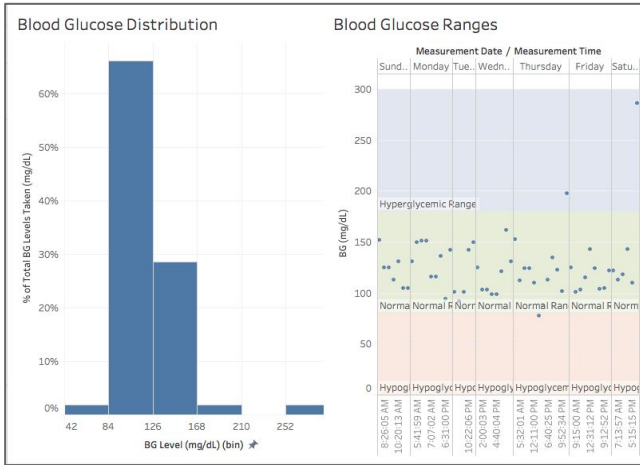
Data Visualizations

Patient-Facing



The scatter plot to the left displays a patient's breakfast-time blood glucose readings over time, with the green band indicating the target blood glucose range. This *allows patients to identify trends of abnormally low or high blood glucose at certain meals or on certain days.*

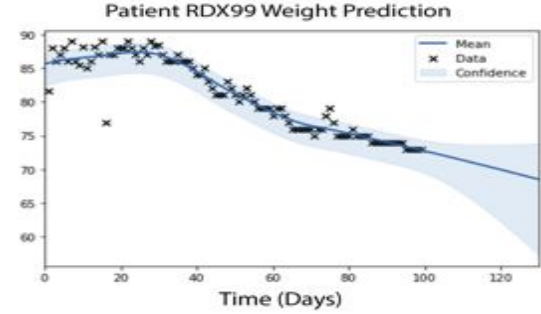
Clinician-Facing



The dashboard to the left displays the distribution of a patient's blood glucose readings, with bar width based on hyperglycemic and hypoglycemic levels. The graph to the right specifies glucose readings by weekday and time so that *clinicians can identify problematic days and times for patients.*

For more, see https://public.tableau.com/profile/daniel.matthew.blue#!/vizhome/interview_1/GlucoseStory

Predictive Analysis



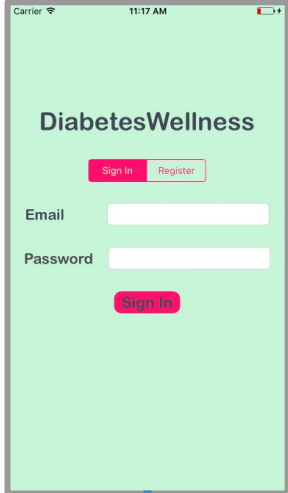
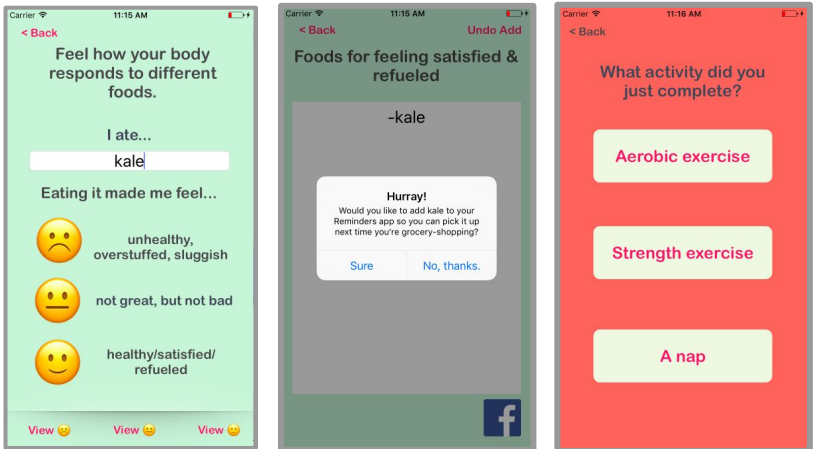
Gaussian Process Regression is a flexible method for performing nonparametric regression. As it provides predictive properties and quantifies uncertainty, we applied it to predict patients' future weights and discern which weights are legitimate (i.e. not from a family member sharing a patient's scale).

Clinician Notifications

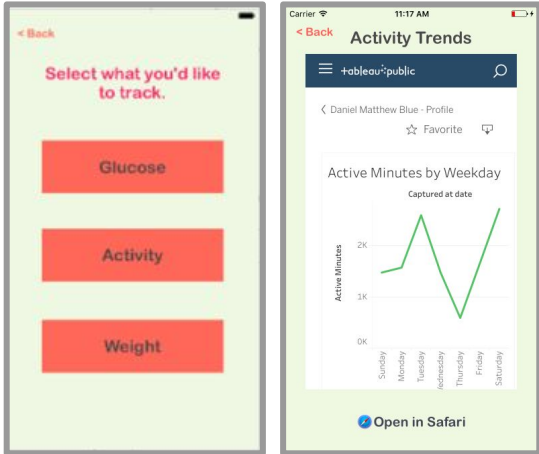
We developed a clinician SMS system to notify clinicians if patients experience consistently dangerous blood glucose levels - information which is especially valuable following changes in medication type, dosage, or timing.

BG reading for patient #2 is at a dangerous level - 260 mg/dL - as of 6/2/17

DiabetesWellness iOS App

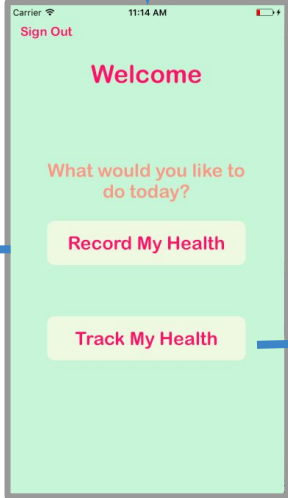


DiabetesWellness
Users register an account with DiabetesWellness and our user authentication is run through Google Firebase with protected credentials.



Record My Health

Under “Record My Health,” a user can input their activity or medication data to be stored and timestamped in a protected Google Firebase database. They can also use our food mindfulness tool to be reminded of foods that made them feel satisfied rather than overstuffed and sluggish.



Track My Health

Under “Track My Health,” a user can find their live health data visualizations (as detailed in the previous slide).

