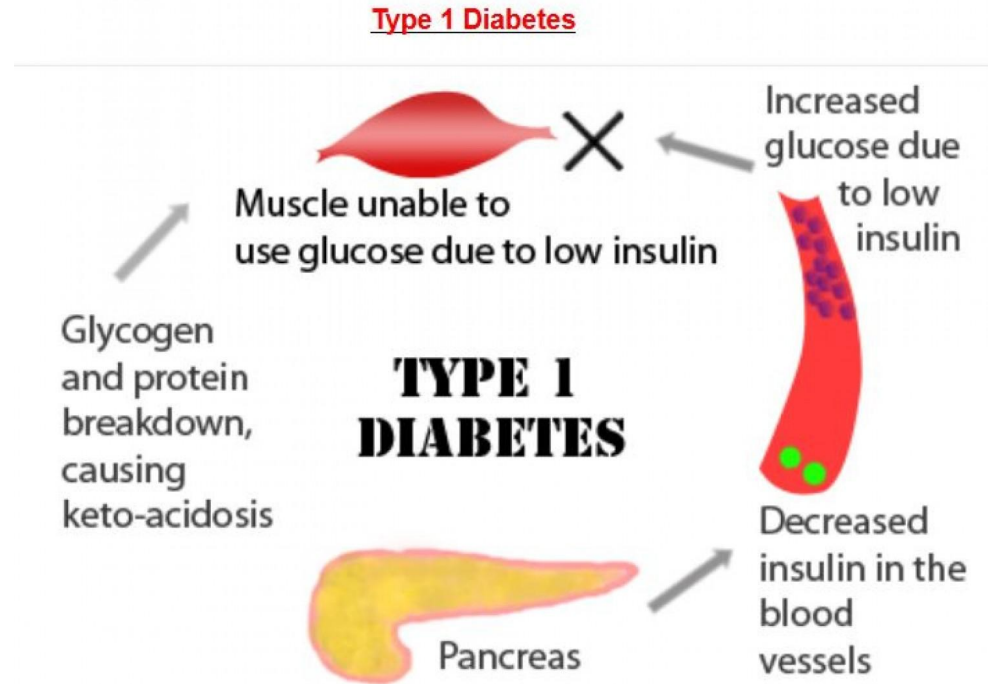# Diabetes Care

Albert, Ian, and Tang

Overview of Type 1 Diabetes

- ~ 3 million Americans
- Autoimmune disease
  - Body destroys insulin-producing cells in pancreas

Type 1 Diabetes

Muscle unable to use glucose due to low insulin

Increased glucose due to low insulin

Glycogen and protein breakdown, causing keto-acidosis

TYPE 1 DIABETES

Decreased insulin in the blood vessels

Pancreas

visual.ly

Overall Problem and Solution

Problem	Solution
● Patients only get feedback from doctors once every 3-6 months ● Devices like the PDM or CGM are expensive and clunky	● Enable direct/instant communication between doctor and device ● Expand access to quality care for all patients

Contextual Inquiry

Interviewee #1: Cody

- Uses injections as opposed to a pump
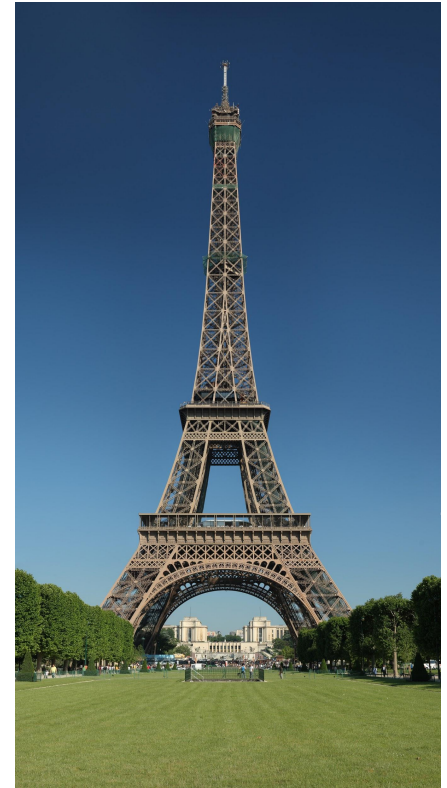- Checks blood sugar 6-8 times/day

Contextual Inquiry

Contextual Inquiry

Interviewee #2: Saniya

- Uses insulin pump and continuous blood glucose monitor
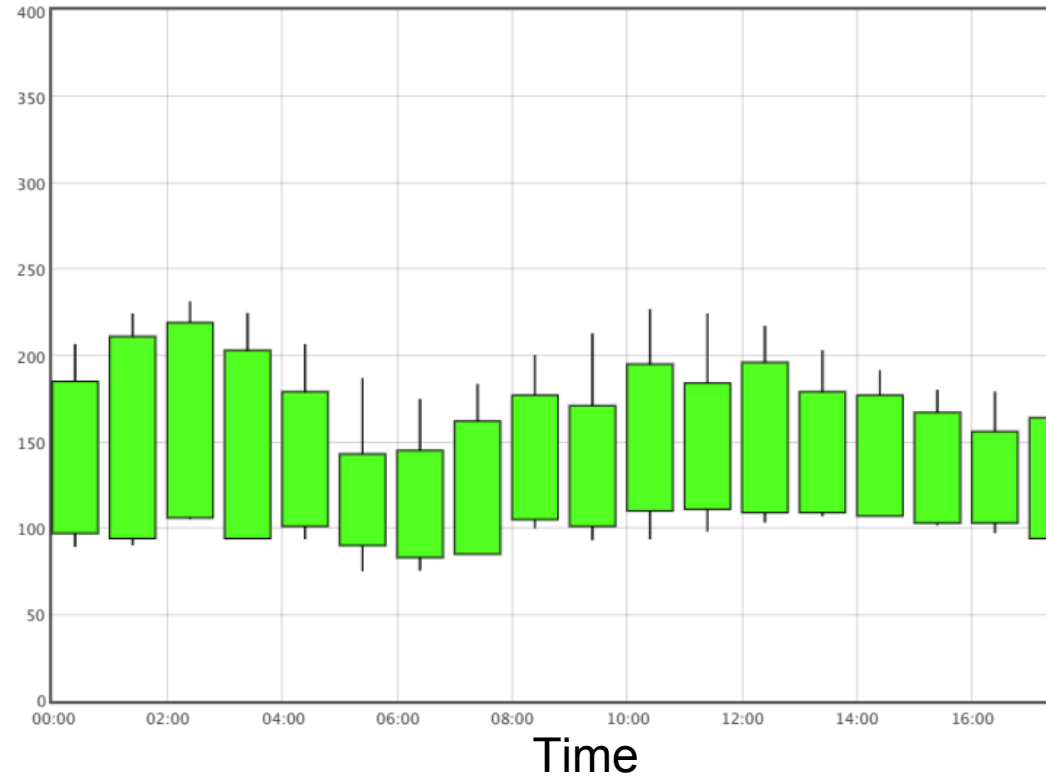- How diet affects her levels

Contextual Inquiry

Hourly Stat Report over last 3 months

Blood Sugar Numbers

Time

Contextual Inquiry

Interviewee #3: Austin

- Athlete - Doesn't like extra units on body
- Self-medicates (insulin dosages)

Task Analysis

1. Who is going to use the system?
   a. People who suffer from chronic disease like Diabetes
2. What tasks do they now perform?
   a. Take insulin
   b. Communicate with doc
   c. Blood sugar measurement
3. **What tasks are desired?**
   a. **Not have to think about it (automatically done)**
4. How are the tasks learned?
   a. Help from device manufacturer and hospital people and parents
5. Where are the tasks performed?
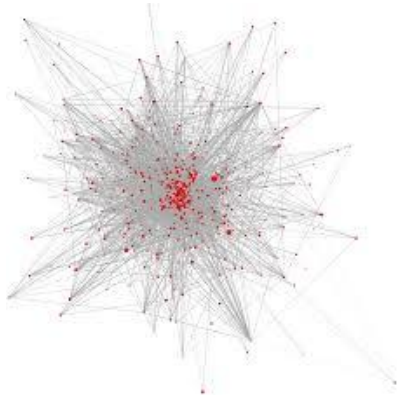   a. Mobile, anywhere

Task Analysis

6. What's the relationship between customer & data?
   a. Want remote access to health history
7. **What other tools does the customer have?**
   a. Hand written notebook and **unit-specific (proprietary) software**
8. How do users communicate with each other?
   a. See doc ~once every 3-6 month
9. How often are the tasks performed?
   a. Testing blood sugar (6-8 times a day)
   b. Emergency (rarely)
   c. Insulin shots (4+ times daily)
   d. Counting carbs (every meal and snack)

Task Analysis

10. What are the time constraints on the tasks?
    a. Taking insulin (must take within 30mins after meal)
11. **What happens when things go wrong?**
    a. **Bracelet + dog tag**
    b. **Educate people around you**
    c. **Call support phone #**
    d. **Carry emergency supply (snack + glucagon)**

Representative Tasks

1. Personal care (changing dosages)
2. Preparing to cover meals
3. Emergency care

Personal care

Preparing to cover meals

Shepherd's Pie? 30 carbs?

Potatoes 25 carbs

Mac 'n' Cheese 40 carbs

Emergency care

Application Ideas

Idea	Resilience	Feasibility	Interest
Color-Coded "Band Aid" Monitor	High	Med	Med.
Directions for Newbies	Med.	High	low-Med
Carb Counting Photo Recog.	High	Med-High	Med-High
Context-Based System	High	med-High	High
Smart Pump Emergency	High	High	High
Mobile D2CG Softw.	High	High	Med-High
Data for Academics	High	High	Med.

Application Ideas

Context-Based System

- collect and use data from location, meals, past experiences, etc. to recommend treatment

Salad: 5 Carbs

Potatoes: 30 Carbs

Application Ideas

Emergency Pump Unit

- Deliver Glucagon if patient has lost consciousness due to low blood sugar
- Automatically contact paramedics and caregivers
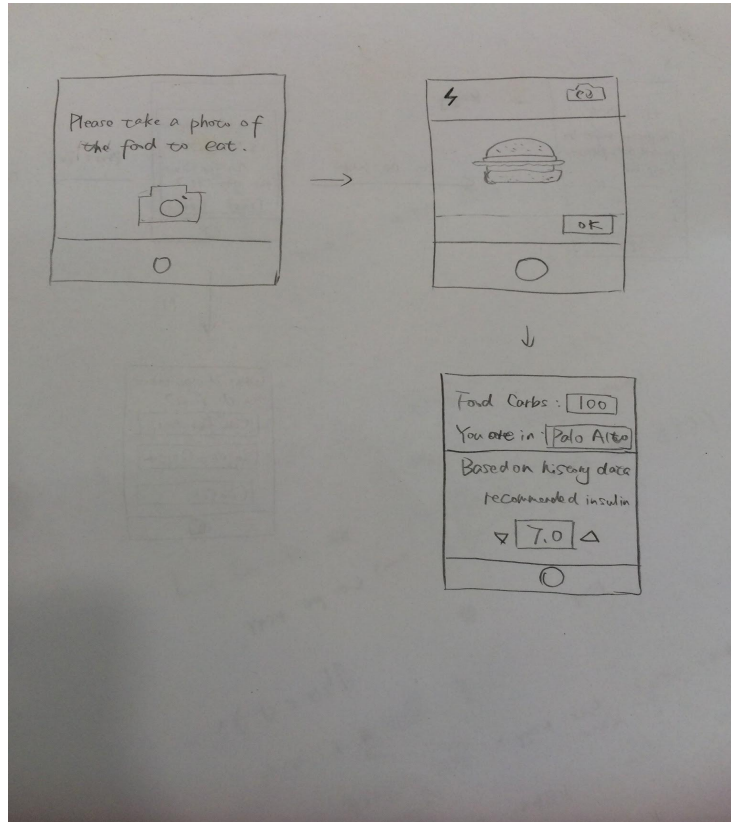
Application Ideas

Mobile Data Shared with Caregiver

- Collect data on phone glucometer/pump
- Upload to the cloud periodically
- Algorithms tell if care has become anomalous & flag for doctor
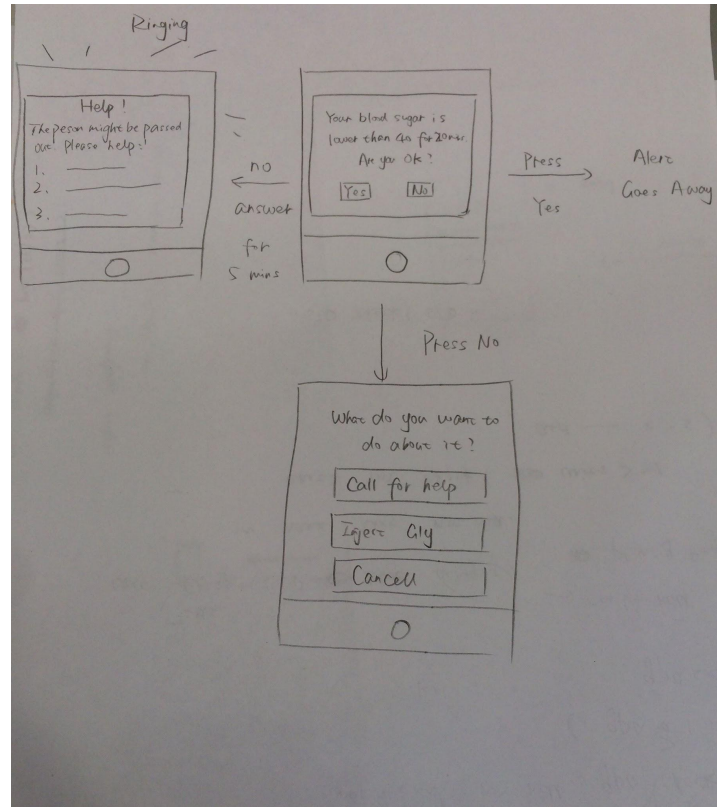- Doc. contacts patient

Sketches

Sketches

Sketches

Sketches
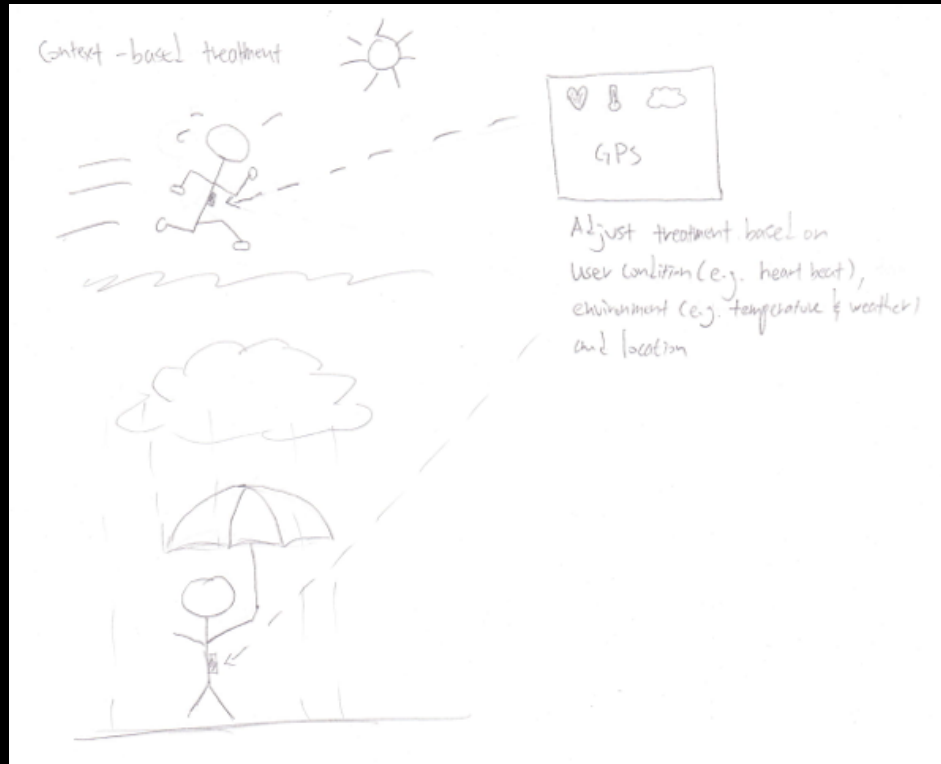
Summary

1. Enable real time treatment by direct access to patient data.
2. Alleviate user stress by "offloading" emergency and daily care to smart wearable devices.
3. Enable context aware/personalized care via smart devices and machine learning algorithms.

Questions?