Mobile Measurement and Motivation: A Feasibility Study of Smart Watches for Health

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BACKGROUND AND SIGNIFICANCE

- Low-income, obese mothers engaged in more physical activity (PA) after participating in a pedometer program (Clarke et al., 2014)

- Pedometers helped school-children maintain PA goals, made parents more aware of children's PA levels, and allowed children to choose the types of PA that worked best for them (Beighle, Pangrazi, & Vincent, 2001)

- Smart Watches "…improve on standard pedometers by measuring and providing feedback on several health/fitness dimensions including calories burned, type of exercise activity undertaken, sleep quality and measurements of heart rate, skin sweat and body temperature." (Lyons et al., 2014)

- Wearable technologies could likely be used on a greater scale to help those who truly need it the most: people with chronic medical illnesses such as emphysema, diabetes, or congestive heart failure (Glatter, 2014).

- *Smartwatches can bridge the gap of time and distance between clinicians and consumers (PwC, 2014).*

STUDY 1

RQ1: Do patients with chronic conditions report interest in using smartwatches to monitor their health?

RQ2: What is the likelihood that patients with chronic conditions will engage with smartwatch technology?

RQ3: Is there a need for smartwatches among individuals with chronic conditions?

RQ4: How do individuals with chronic conditions describe the reasons for which they would use a smartwatch to monitor their health?

METHOD

Participants
- N = 27 (21F)
- Employees at a local clinic
- Chronic conditions (diabetes, hypertension, asthma, and obesity)
- Caucasian (n = 12), Hispanic or Latino (n = 7), African American (n = 7), Pacific Islander (n=1)
- Ages: 42-65

Measures
- Semi-structured interviews (in-person, 15-45 minutes in length)
- Questions targeted: attitudes toward technology, comfort with using new technology, communication about technology within social networks, and how smart watches would be used to manage condition

Interview Coding
- A codebook was created based on emerging themes and all of the transcripts were coded by a trained coder.

THEMES

Motivation and Guidance
"This job has me sitting on a chair and it's going to be tough but I know friends or co-workers that go walking on their breaks, their lunch, as long as you can deal with the heat. If nothing else I said I'm going to walk when I get home. I don't know that I'll get those 10,000 steps in daily. On the weekends I might have a better chance."

Trust in Care Providers
"If the doctor said you're probably going to get something out of this or this is the best way to monitor this, then I would probably say 'yes.'"

Taking Control of the Condition and Replacing Inconvenient Devices
"If that was available in the stores I would buy it just so I could have that option. If I'm not feeling to well, and I'm not sure what's going on, one of my first go-to's are to schedule an appointment with the doctor, go in and really all I want is for that little, is a little device that clips on to your finger and do that so I can determine if my oxygen levels are high."

Access to Health Data
"The option of having a new tool to use and it's pretty cool. Giving me the information, the useful data. Having access to their own health data is definitely something patients like."

Cost as a Barrier
"It has been in the news a lot that these devices are really great, but pricing is a little bit hard to swallow right now."

Wearability as a Barrier
"The comfort and the flexibility and just making sure that it felt comfortable and not that it was just ... Oh, and if it was waterproof."

Social Network
" I would love it. I would want to team up with that family member. My daughter is overweight and I would love for her and I to team up together."

STUDY 2

RQ1: How do two different smart watch models compare in their ability to track activity?

RQ2: How do two different smart watch models compare in their wearability?

METHOD

<u>Devices</u>: Moto 360 and Samsung Gear 2

<u>Part One</u>: Comparing dominant and non-dominant write test for accuracy and consistency

<u>Part Two</u>: Comparing sensor data collection for accuracy and usability through user surveys

-Five day pilot with 3 graduate student subjects

PRELIMINARY FINDINGS

- Activity and step data **largely consistent**
    ~5% difference across devices;
        Some small activity differences (e.g., distinguishing between cycling and riding a car)
        Heart rate shows a lot of missing readings and variability across time and devices on the tested devices
- **Hard to mine individual patterns** using existing processed data from **small scale trials**.

- Better results may be achieved **by constantly collecting data** on shorter intervals or collect more **granular**, **low level data** (accelerometer, gyroscope), which is very battery consuming

- Crossing **location**, **time** and **activity** information allows for a detailed view of the user's routine
        -Easy to find **home**, **work** and regular **stopping places**.
- Most people do **not know** or **care** about how much or what location data is collected
- These location data are **NOT available** to other companies or services outside Apple/Google, unless specifically allowed by the user

Daily Step Data for Subject A

Step Data for Subject A (One Day)
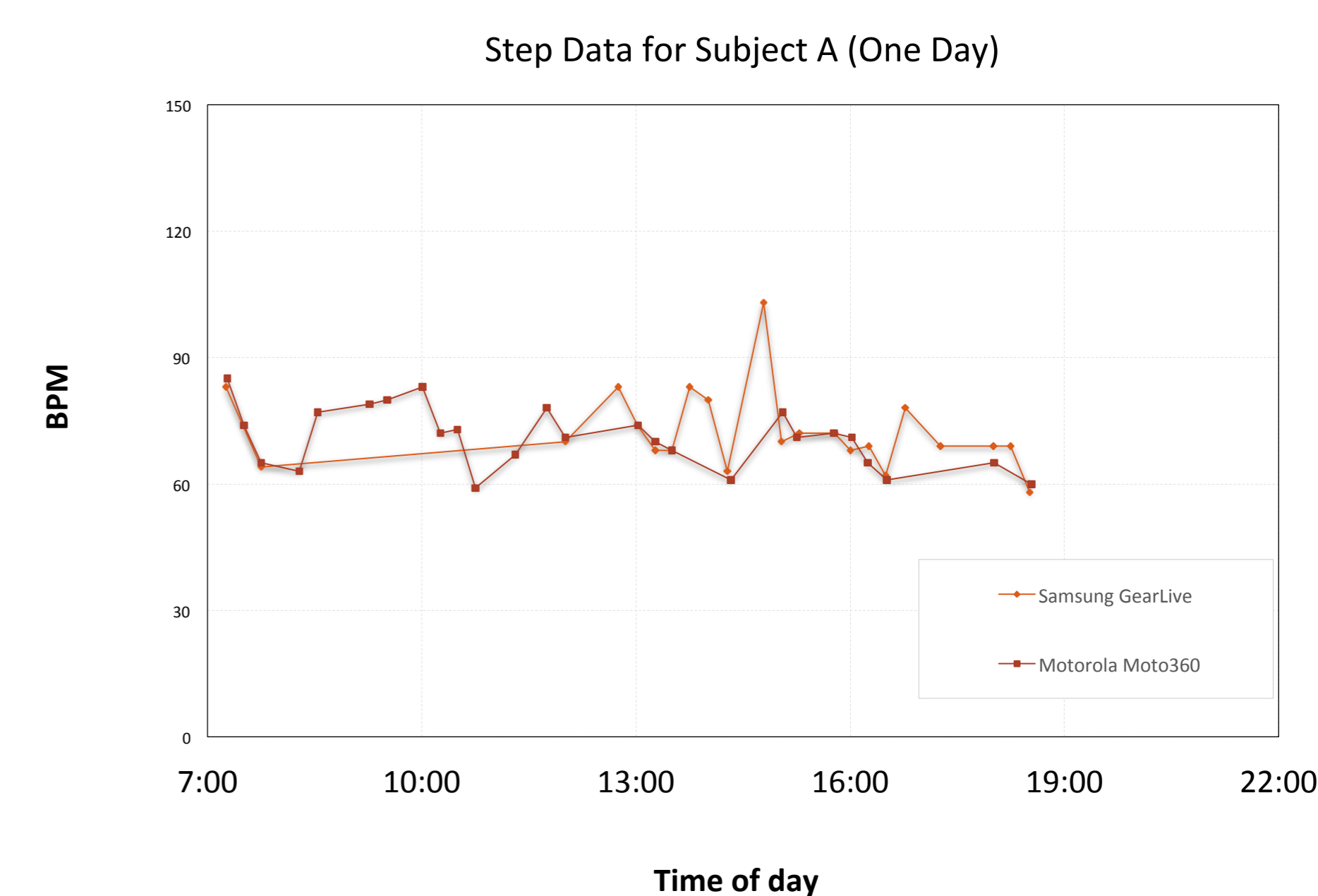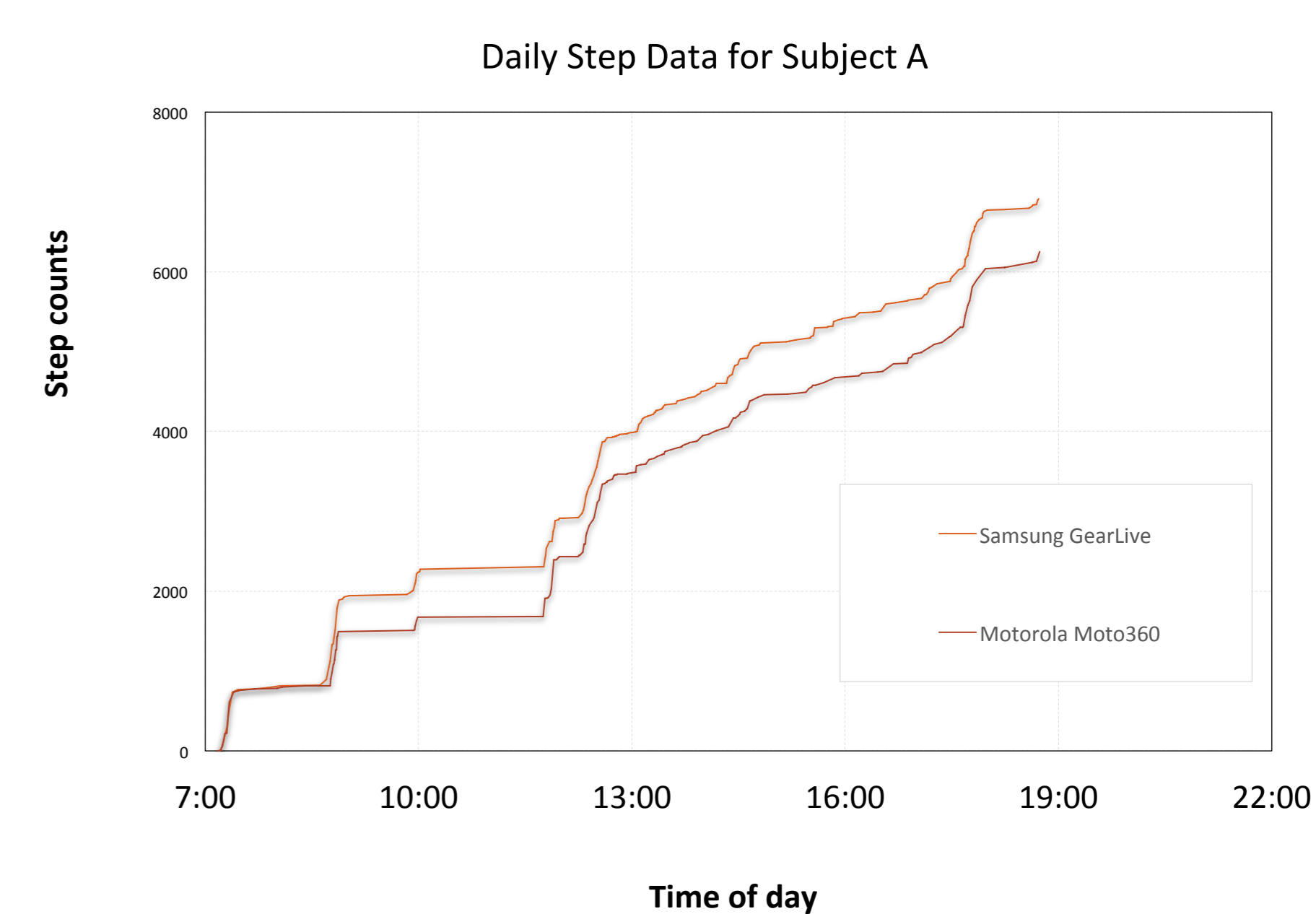
CONCLUSIONS

- Smart watches have potential for health research, but sensor accuracy and consistency raise questions
- Heart rate reports sensor data had a lot of missing readings and high variability across time and device
- Better results may be achieved by constantly collecting data on shorter intervals or collecting more granular, low level data using a benchmark device