PART 14 AndWellness II: 3 Pilots to assess diet, stress, exercise, energy, mood, and sleep in diverse populations

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Overview
We have deployed AndWellness with a number of pilot studies to begin to evaluate how well AndWellness meets its design goals of engaging participants while providing valid and reliable data. These pilot studies include several internal technical pilots to evaluate validity and reliability of the automated exercise monitoring, research study of breast cancer survivors, and a pilot study with young mothers to evaluate the validity and reliability of the survey and automated data collection using AndWellness.

Approach: Construction of Study
In a research study, AndWellness facilitates the collection of survey data collected by prompting the participant to answer questions on the phone, and actigraphy data which is continuously collected without human input by sampling the onboard GPS and accelerometer devices onboard the phone to infer the participant's current activity. All responses are time-stamped and geo-tagged, and uploaded to a server using a delay-tolerant reliable transport protocol when network access is available. Surveys can have one of five types of questions, and surveys can branch to different questions based on a participant’s response. Finally, participants can be prompted to complete surveys using the AndWellness reminder framework. Reminders are based on time, location, and/or sensor readings. Each individual participant can modify the trigger settings on their mobile device. When a trigger fires, the Android notification system rings or vibrates and displays a small message to the participant. The flexibility of the trigger system along with personal trigger customization reminds participants to collect data while conforming to the participant’s daily schedule. Using our trigger framework, a number of parameters can be configured using the GUI, including the time and location of trigger, and the number and duration of notifications.

System(s) Description and/or Experiments
We have three ongoing studies that are currently utilizing AndWellness.

Cardiovascular disease risk factors and behaviors in young moms
Behavioral researchers at UCLA are using AndWellness to study cardiovascular risk factors in young mothers. Basic measurement parameters included a participant's daily exercise routines, their diet, and their stress and mood levels throughout the day measured by survey; and a participant's mobility recorded continuously using our automated mobility classifier. In-person assessments will occur at baseline, 3, and 6 months, and consist of retrospective self-reports and minimally invasive biomarkers to evaluate validity and reliability of phone measures.

Randomization will occur in two stages. First Moms will be randomized to a self-monitoring condition where participants carry smartphones running ANDWellness (n=45) or a control condition with no self-monitoring and no phones (n=15). Moms in the self-monitoring condition will be randomized to receive probes in one of three schedules (n=15 fixed time schedule, 15 random, 15 location-based), to occur 4 times a day. Probes will remind participants to complete a survey on diet, stress, or exercise. Additionally participants will have the option of recording diet and stress events using the phone’s desktop buttons. ANDWellness will assess compliance to the survey reminders. The strategy for evaluating the reliability and validity will take place over two 3 month periods. In the first 3 months of carrying mobile phones, the phone data collection will establish the base rate for all four assessed behaviors. During the second 3 month period, ANDWellness will provide real-time feedback comparing Mom’s current behavior with base-rates established in the first 3 month period for all assessed behaviors and compliance to the phone’s reminders. The primarily aims of the study are to first, examine the validity and reliability of phone data on assessed behaviors, through comparison with biomarkers and retrospective surveys; and second to preliminarily examine trends and correlations in assessed behaviors and compliance to the phone associated with the type of probe schedule (fixed, random, and location-based), and real-time feedback.
We have 15 participants that have taken part in a 1-week pilot version of this study, and have over 90% compliance in survey data collection. In this 1-week pilot, participants are additionally asked to complete a 30 minute scripted activity involving sitting, walking, and running for 10 minutes each, in order to evaluate the validity and reliability of the mobility classifier. Current results for two participants of over 90% accuracy are promising, but more data is needed before conclusions can be drawn.

SleepSens
SleepSens is a study of participant's sleep habits that asks participants to answer an eight-question survey when they first wake up in the morning. It also uses a sleep detection algorithm that approximates when a person goes to sleep and when a person wakes up by detecting phone movements. It uses this wake detection to send a reminder to the participant to take the survey. SleepSens is able to approximate a person's sleep patterns through its internal sleep and wake detection components, by continuously sampling the accelerometer onboard the phone. Once it is approximated that the user is awake, SleepSens will put itself to sleep until a hard-coded time later in the day. This prevents SleepSens from consuming unnecessary battery power. We have approximately 20 participants all of which have more than 90% compliance with filling out the daily survey.

ABC
AndWellness is currently employed in a study to measure the mood and energy in young breast cancer survivors. The study includes four surveys triggered throughout the day: The sleep survey is triggered in the morning and queries about the previous night’s sleep and prompts participants to measure their stress levels by swabbing their cheek with a q-tip and saving the sample; the mood survey is triggered mid-morning, mid-afternoon, and in the evening, and includes 10 mood and stress prompts; the exercise and substance use prompts are also grouped in the evening survey. We have approximately 20 participants, with more than 90% compliance with the survey data collection.

Accomplishments
We have conducted focus groups with potential participants, and interview and pilots with participants, receiving overwhelmingly positive feedback about the design and implementation of AndWellness:

- Focus groups with over 60 diverse potential users of a mobile self monitoring system like AndWellness
- Three pilots ongoing with over 50 participants, studying diet, stress, exercise, mood, energy, and sleep.
- Interviews and surveys with over 30 participants that have used AndWellness.

Almost every participant asked in our interviews has said that they would find AndWellness useful in their personal behavior management; most participants appreciated the reminders and configurability provided by the trigger framework.

We have ongoing collaborations with several Universities outside of UCLA (Arizona State University, Northwestern Medical University, and UC San Francisco), and numerous requests from people domestically and internationally to use the AndWellness platform.

Future Directions
In the coming year, our three ongoing pilots are expected to complete, and at least three more planned pilots will be completed. The AndWellness software platform will be used as the basis for the Mobilize project in collaboration with the Exploring Computer Science curriculum at local high schools in Los Angeles Unified School District, therefore development resources will be focused on ensuring that AndWellness meets requirements of both Mobilize as well as ongoing and future behavioral studies. Finally, AndWellness will be released as open source software.