PART 01 AndWellness: Improving Wellness with Mobile Personal Sensing

PART 01.1 Overview
Mobile phones can radically personalize health care by providing more accurate and reliable data from individuals. However, a mobile architecture needs to provide privacy, engaging interfaces to encourage adherence, a way to present the large quantities of data, and be evaluated in rigorous side by side tests in real patient pilots.

We are building AndWellness, a mobile personal sensing application for the Android platform that includes a suite of mobile services, and server-side software to improve personal health and wellness. As a collaboration between the Center for Embedded Networked Sensing and the Global Center for Children and Families (http://www.gccf.ucla.edu/), AndWellness will transform mobile devices into tools that uncover a user's behaviors at the heart of personal wellness without violating their privacy, and help users design customized interventions to improve their health. Customizable spatial-, social-, temporal-, and mobility-triggered reminders, assessments, and interventions are relevant to a wide array of behavior change objectives. AndWellness will initially focus on a subset of these behaviors in a series of pilots, as described in Section 14.5 below.

PART 01.2 Approach

Ecological Momentary Assessments
Adherence to a behavioral intervention can often be more important than the intervention itself. Self-monitoring is critical to improving adherence to behavior change programs (Donavan, 2005; Marlatt, 1985). But human memory is fallible: Frequency estimates for discrete events tend to cluster about round numbers (e.g. 20/day vs. 19); recall of conditions preceding a salient event may be systematically distorted by knowing the outcome (i.e. “I must have felt badly to do such a thing”); current mood state may affect the availability of exemplars for retrieval from memory (e.g., recent eating influences recall of a previous hunger); and it is easy to backfill, forward fill, or fake fill (Piasecki, 2007; Hufford, 2007).

To improve outcomes by augmenting human memory, EMA was developed to monitor affect, cognitions, and behavior in real time in a person’s natural environment (Shiffman, 2007). EMA is implemented through the use of a portable electronic or recording device, such as a cell phone. Data is collected in real time, so is not subject to recall and retrieval biases (Schwarz, 2007); Data is harder to fake (Collins, 2003; Hufford, 2007); Errors are identified early (Collins, 2003); Data is instantaneously entered into a secure central database. EMA can aid in contextual, spatial, or temporal associations to behaviors; especially well suited for tracking short, discrete events (Shiffman, 2008).

Design Approach
In order to design the system, we are using a Continuous Quality Improvement cycle, which is an iterative, 3 step cycle:

- **Key Informants.** We are interviewing behavioral experts, medical providers, and professionals who have experience working with target communities, and with mobile phone based interventions.

- **Focus Groups.** We are recruiting participants from our specific target communities to test prototypes, and provide feedback on screen layout, periodicity of reminders, terminology, configurability, privacy, and data presentation.

- **Design Experts.** We translate the constraints from the Key informants and Focus groups into technical specifications which can be implemented, and provided to Focus groups for evaluation.

PART 01.3 System Description
We propose to build a three tiered architecture consisting of the mobile phone (Figure 1), a personal data vault, and a back-end server. A website will provide (1) trigger authoring (2) real-time Feedback (3) place labeling (4) PDV interface (5) visualizations and patient dashboards (6) usage Monitoring statistics. The mobile phone will provide (1) an engaging UI (2) power management (3) automated activity classification. The mobile phone will include components to monitor usage. The entire system will be built using standardized data formats and modular components for robustness.

PART 01.4 Accomplishments
We have built an end to end system that is ready for pilot evaluation. We have undertaken several internal pilots to evaluate the technical feasibility and validity of the mobile phone measures, and completed several Key informant interviews. We are now in a recruitment phase for our focus groups.
PART 01.5 Future Directions

We plan to undertake a number of pilots this year with diverse populations, to evaluate the reliability, validity, usability, and effectiveness in behavioral interventions of AndWellness.

Cardiovascular Risk factors, 60 Moms. In this NIH funded study, we will provide mobile phones to young moms for 6 months, to help them self-monitor diet, stress, and exercise, three key risk factors for cardiovascular disease. We will use the data from the pilot to evaluate the validity, reliability, and usability of the AndWellness application.

- Exercise, mood, and energy levels, 100 Breast Cancer Survivors. We will provide mobile phones to young breast cancer survivors. We are integrating mobile phone monitoring into an existing study run by Professor Patti Ganz to obtain quick feedback from small groups of users.
- Sex and co-occurrence with alcohol and drug use, 30 Gay men. In this Center for HIV Identification Prevention and Treatment funded study, we will provide mobile phones to at risk youth to collect highly sensitive information to better explore the tradeoff between privacy needs and study compliance.
- Exercise, 30 South Asian Women. In this Northwestern University funded study, we will work with practitioners from Northwestern Medical campus to evaluate the validity, reliability, usability of mobile phones in an older, immigrant population, and explore the mobile phone as a behavioral intervention tool to encourage exercise.