

# Mobile Phones for Self-monitoring & Self-management among People Living with HIV

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# ohmage: an mHealth platform for research and intervention

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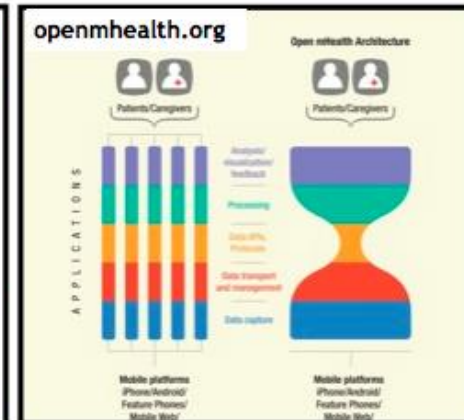
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[www.ohmage.org](http://www.ohmage.org) & [www.openmhealth.org](http://www.openmhealth.org)

Enabled by  $>5 \times 10^9$  mobile phone users, increasingly with: GPS, imagers, touch screens, Internet, app stores

Motivated by  $6 \times 10^9$  people on planet earth, their health needs, and economic realities



# Methods: 3 related disciplines

- Experience Sampling Method (ESM)
  - Psychology (Hektner, Schmidt, Csikszentmihalyi)
- Ecological Momentary Assessment (EMA)
  - Psychology (Stone, Shiffman, Smyth)
- Ambulatory Assessment
  - medicine / Europe, biomarkers (cortisol, bp, etc.)
- *Reactivity?* – Nuisance or Opportunity?
  - ***EMI (Ecological Momentary Intervention)***

# Participant-involved/generated data

- Self-report surveys
- Brief open-ended reports & "annotations"
- Digital still images, video, audio & associated annotations
- EVERYTHING time-stamped and, when appropriate, location-stamped (on smartphones)

# Unobtrusive & low-burden data

- on Smartphones and similar devices:
  - Location (GPS, cell tower & wifi triangulation)
    - infer mobility & location
  - Accelerometers
    - infer activity (movement, exercise, sleep, etc.)
  - Call logs & SMS (text-message) logs
  - Peripheral devices – biosensors, blood sugar, etc.

# Sampling/Triggering Schemes

- Participant initiated
- Time-based prompts
- Location-based prompts
- Other sensor data-based prompting
  - Accelerometers, Blue-tooth & Wifi, Peripherals, others?
- Random prompts
  - Also linked to other data, including other data sources

# Sampling Frequency

- Anticipate frequency of "experience" :
  - In the moment / EMA
  - Multiple times per day "near experience"
  - Daily "diary" - once per day
  - Weekly or more – short-term retrospective
  - **Adaptive** in some way?
    - e.g., if lot of "no" reports then reduce frequency of prompts, or if "yes" increase frequency

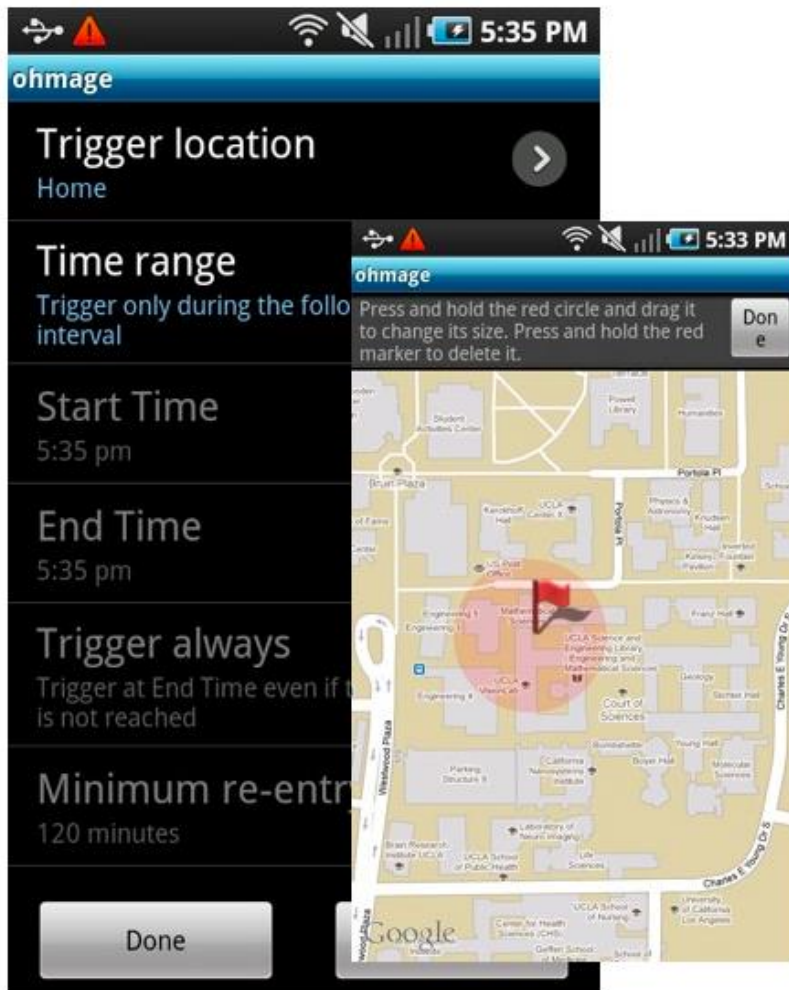
# PLH in L.A. (completed this week)

- 50 PLH randomly assigned to:
  - 2/3 smartphones w/ daily surveys over 6-weeks
  - 1/3 web-surveys only every two-weeks (control)
- Goals – user experience, feasibility, validity, reliability, benefits?
- Measures
  - Medication, Sexual Behaviors, ATOD use 1/day
  - Depression, Anxiety, Fatigue, Energy 4x/day
  - “Participatory” Stressful-events & Photo diary
- Visualization on website
- Next phase
  - Methamphetamine Using MSM in outpatient tx
  - Viz on phone, Goal setting, share data w/Counselor

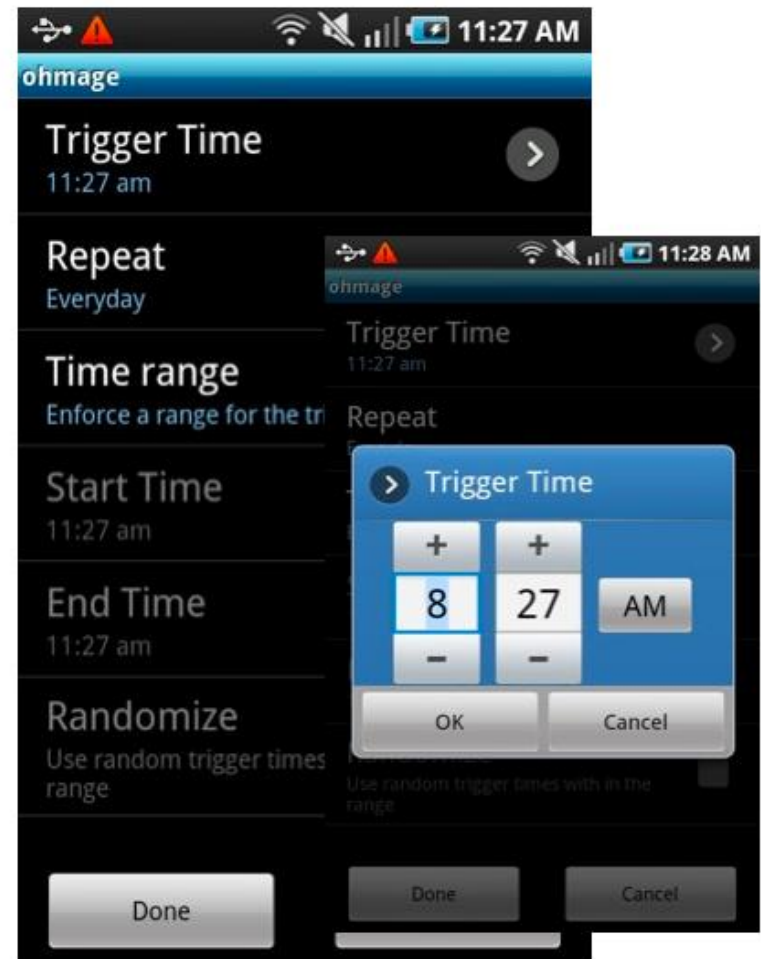


# Smart Reminders

## Location-based



## Time-based



Tangmunarunkit, et al

# Smartphone Apps

- maximum options
  - time, location/GPS, unobtrusive/background, etc.
- more technically involved programming
  - especially for unobtrusive data, battery life, etc.
- App incompatibility across phones
  - even with same OS (Android) not all devices will work
  - most likely have to provide phones to participants
- Researcher/Clinician authorable web-interfaces
  - under development, e.g., Ohmage.org

# SMS “Text-Messaging” & IVR

- Text-messaging (SMS)
- Interactive Voice Response (IVR)
- Multi-media Messaging (MMS)
  - universally available on all phones (except MMS)
  - only time-stamped data and time-based prompts
  - no GPS/location prompts or unobtrusive data
  - need SMS/IVR back-end system & programming for anything but small-scale SMS applications

# Mobile Web Framework (MWF)



# Mobile Web Framework (MWF)

- New technology from UCLA (based on HTML-5)
- works on any phone with a web browser
- better user-interface (than “feature phones”)
- more easily programmable than apps
- time-stamped data & time-based prompts
- GPS/location-based prompts and data
- Other unobtrusive data collection (maybe?)
- not yet universally available

# Validity & Reliability Challenges

- Major challenge recognized by mHealth innovators
- Lack of gold standards for EMA/ESM
- Limited examples of measures to draw upon
  - most are very specific to a particular research question
  - e.g., how many dimensions of mood - chunking & splitting issues
- Mixed-methods measurement development is an ideal approach
- Adapt current gold standard retrospective self-reports is quick and dirty approach

# Challenges

- Missing data, Multiple data sources
- Utilization, Utility, Compliance, Incentives
- Participatory approach for engagement versus consistently completing surveys
- Data access & utility
  - real-time processing, visualization, & feedback
- Rapid improvements since study start
- How to Analyze Data? Stats & mixed methods