Title

Workgroup 1 - **Digital Infrastructure**
Recommendations from the Digital Sensing Workshop held at UCLA Feb 28-March 2, 2023

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Digital Sensing Workshop Participants (https://ucla.box.com/v/dig-sensing-wkshp-pubroster)

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DIGITAL INFRASTRUCTURE

WORKGROUP #1 – COMPILED RECOMMENDATIONS

These recommendations were compiled as an output of the Advancing the Utility of Digital Sensing Tools for Mental Health Research workshop ("Digital Sensing Workshop") sponsored by the UCLA Depression Grand Challenge, Wellcome Trust and NIMH. Workshop participant roster may be found at: https://ucla.box.com/v/dig-sensing-wkshp-pubroster.

Please submit feedback at https://bit.ly/dig-sensing-report-feedback by August 31, 2023.

PRIORITIZED LIST OF OBSTACLES AND GAPS

1. **Managing version changes and between-device differences (for the same measure)**
   This functionality is fundamental for making data and findings comparable, between devices and over time within the same device (e.g., lack of standards for minimum sensor reliability, communication around the evolution of features/algorithm) and importantly, across studies.
2. **Need to identify common ground between device manufacturers and other stakeholders including users, academics**
   Including model to share data between specific collaborators (legal frameworks, where does common data live, standard ICFs to enable data pooling)
3. **Plug and play study infrastructure**
   Easier to stand up research projects
   Collect / store / manage and analyze data in repeatable way
4. **Limited APIs/SDK for low level data access and processing**
   To aid development of next generation of devices and models
5. **May not have the most effective sensors on devices today**
   Identify high-priority areas to expand sensing into and communicate that device manufacturers and other stakeholders

Key takeaways for device manufacturers

- Make subsequent API versions available simultaneously
  (to enable cross-version comparisons)
- Sunset old versions after pre-defined period
  (e.g., one year / two years)
- Provide internal comparisons of algorithms
  (e.g., changes in mean for a given sensor variable)
- Communicate other known changes in each version through a central documentation source
- Work to identify other best practices in managing versioning and reproducibility from other domains (e.g., from EHR data systems)
- Clear process for the community to advocate for new data types, capabilities, support
  - Where to make such requests
  - E.g., gaps in data documentation (e.g., expected range for each data type)

(1) VERSION CHANGES AND BETWEEN DEVICE DIFFERENCES FOR THE SAME MEASURE

MAJOR MILESTONES & DELIVERABLES AND ASSOCIATED TIMELINES

- Review of what standards exist in this space
- Create working group to define standards for device manufacturers working with researchers (leverage IEEE 1752 working group, involve device manufacturers)
    - More information on existing measures (work with IEEE 1752)
        - Publish specs for each measure (e.g., minimum data, metadata , error bounds)
        - Say when algorithm + sensor specs change, what changed
        - Sunset period defined

KEY STAKEHOLDERS TO ENGAGE

- Device manufacturers

REQUIRED RESOURCES

- Grad student resource

(2) NEED TO IDENTIFY COMMON GROUND BETWEEN DEVICE MANUFACTURERS AND OTHER STAKEHOLDERS INCLUDING USERS, ACADEMICS

MAJOR MILESTONES & DELIVERABLES AND ASSOCIATED TIMELINES

- Forum of device manufacturers as convening mechanism
    - Hear from lived experience consumers
    - Receive representative feedback from research community on new sensing development
    - Define a pre-competitive space and value proposition for growing mental health applications
    - Publish easy-to-digest stakeholder "value propositions" for stakeholders across value chain
    - Engage other industry players
    - Maintain inventory of studies and devices being used

KEY STAKEHOLDERS TO ENGAGE

- Lived experience participants
- Device manufacturers
- Regulators – FDA
- Payers

REQUIRED RESOURCES

- Support for collaboration/consulting with DiMe

(3) PLUG AND PLAY STUDY INFRASTRUCTURE

MAJOR MILESTONES & DELIVERABLES AND ASSOCIATED TIMELINES

- Systematic review of mental health sensing projects with infrastructure, lessons learned, what do we need moving forward (lessons learned from prior attempts e.g., UCSF model, and leverage mHealth learnings more generally where possible)
- Funder support for broadly available infrastructure "centers of excellence" – "REDCap Plus" for digital phenotyping (e.g., Research Stack in mHealth)
    - Network of sites with expertise
    - Upfront funder investment to "prime the pump" (training, infrastructure buildout), and then self-sustaining through costing into grants for ongoing studies that use the infrastructure
    - 'Directory' of reusable portions (apps, backend platforms, etc.) of infrastructures
    - Unified data storage approach – e.g., NIH Common Fund agreement with cloud providers
    - Minimum standard of API interface

KEY STAKEHOLDERS TO ENGAGE

- Funders (Wellcome, NIH – NIMH, NIBIB)
- Cloud infrastructure providers

REQUIRED RESOURCES

- Grad student / post-doc for systematic review

(4) LIMITED APIS/SDK FOR LOW LEVEL DATA ACCESS AND PROCESSING (CLOSELY LINKED TO PRIORITIES #1 AND #2)

MAJOR MILESTONES & DELIVERABLES AND ASSOCIATED TIMELINES

- Mechanism for researchers to suggest new capabilities / needs in sensing
    - Unified funnel coming from the research community writ broad
    - Consider also leveraging manufacturers' other forums (e.g. researchers invited to WWDC)

KEY STAKEHOLDERS TO ENGAGE

- Device manufacturers

REQUIRED RESOURCES

- FTE effort TBD

(5) MAY NOT HAVE THE MOST EFFECTIVE SENSORS ON DEVICES TODAY

MAJOR MILESTONES & DELIVERABLES AND ASSOCIATED TIMELINES

- Forum of sensor experts and mental health workshops to brainstorms and refine what measures don't exist but need to be created (e.g. biofluid sensing)
    - i.e., next session in next workshop here
    - Include recommendations on how to best fund sensor development (from research to scale)
- Publication and formal communication to funding agencies

KEY STAKEHOLDERS TO ENGAGE

- Mental health experts
- Sensor experts
- Lived experience participation
- Funders

REQUIRED RESOURCES

- Workshops funding